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User's Guide for the Coupled Ocean/Atmospheric Mesoscale Prediction System (COAMPS) Version 5.0

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14. ABSTRACT

The Coupled Ocean/Atmospheric Mesoscale Prediction System (COAMPS) Version 5.0 is a fully coupled, data assimilative model which consists of both COAMPS Version 3 and the Navy Coastal Ocean Model (NCOM) Version 4. Coupling of the two models is accomplished via the Earth System Modeling Framework (ESMF) in which surface fluxes of momentum and moisture are exchanged across the air-sea interface. This version of the user's manual (1.0) includes instructions to upload and setup COAMPS Version 5.0 on a user's workstation or on the High Performance Computing Modernization Program (HPCMP) DoD Supercomputing Resource Center (DSRC) platforms. Step-by-step instructions include using subversion control to upload COAMPS Version 5.0 code and namelists, setup of COAMPS and NCOM input/output directories and namelists, input data acquisition, creation of high-resolution grid setup namelists using both COAMPS-OS (On-Scene) and RELO NCOM, and execution of COAMPS Version 5.0.

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1.0 INTRODUCTION

The Coupled Ocean/Atmospheric Mesoscale Prediction System (COAMPS®[i]) Version 5 is a coupling of the COAMPS Version 3 model with the Navy Coastal Ocean Model (NCOM) Version 4.0, via the Earth System Modeling Framework (ESMF). In this fully coupled mode, COAMPS and NCOM models can be integrated concurrently so that precipitation and surface fluxes of moisture and momentum are exchanged across the air-sea interface.

COAMPS receives input from the Navy Operational Global Atmospheric Prediction System (NOGAPS) in the form of meteorological observations, satellite data, and ship reports. It acquires ocean observations and bathymetry from global NCOM. Atmospheric and oceanographic model output includes surface and upper air parameters, sea surface temperature (SST), 3D temperature, salinity, velocity, 2D mixed layer depth, and acoustic products. Coupling can be both one-way and two-way, as well as with or without data assimilation. Data assimilation is facilitated through the Navy Coastal Ocean Data Assimilation (NCODA) system. The NCODA is a fully three-dimensional multi-variate optimum interpolation (MVOI) routine that produces simultaneous analyses of temperature, salinity, geopotential, and vector velocity (Cummings, 2005).

1.1 Coupled Ocean/Atmospheric Mesoscale Prediction System (COAMPS®)

The Naval Research Laboratory (NRL) Marine Meteorology Division's COAMPS® makes both mesoscale and microscale predictions of the atmosphere and ocean. The atmospheric elements of COAMPS are used operationally by the U.S. Navy for numerical weather prediction in various regions around the world. COAMPS consists of a complete 3D MVOI data assimilation system with data quality control, analysis, initialization, and forecast model components (Hodur, 1997; Chen et al., 2003). Data assimilation is initiated by the prior 12-hr forecast and incorporates quality-controlled observations from aircraft, radiosondes, satellite, ship, and surface stations. The MVOI analysis employs both *in situ* and satellite SST measurements (Pullen et al., 2007). COAMPS includes a globally relocatable grid, user-defined grid resolutions and dimensions, nested grids, an option for idealized or real-time simulations, and code that allows for portability between mainframes and workstations. The nonhydrostatic atmospheric model has predictive equations for momentum, non-dimensional pressure perturbation, turbulent kinetic energy, potential temperature, and the mixing ratios of water vapor, clouds, rain, snow, and ice. It includes Louis surface flux parameterizations for boundary layer processes, precipitation, and radiation (Louis et al., 1981). COAMPS has 30 vertical terrain following levels.

1.2 Navy Coastal Ocean Model (NCOM)

Manuscript approved October 15, 2009.

The Navy Coastal Ocean Model (NCOM) Version 4.0 is based primarily on two existing ocean circulation models, the Princeton Ocean Model (POM) (Blumberg and Mellor 1983; Blumberg and Mellor 1987) and the Sigma/*Z*-level Model (SZM) (Martin et al., 1998). NCOM Version 4.0 has a free-surface and is founded on the primitive equations and the hydrostatic, Boussinesq, and incompressible approximations. The Mellor Yamada Level 2 (MYL2) and MYL2.5 turbulence models parameterize the vertical mixing. The Large et al. (1994) vertical mixing enhancement scheme is available for parameterization of unresolved mixing processes occurring at near-critical Richardson numbers. A source term included in the model equations allows for the input of river and runoff inflows.

NCOM employs a staggered Arakawa C grid (as in POM). Spatial finite differences are mostly second-order centered, but higher-order spatial differences are optional. NCOM has a leapfrog temporal scheme with an Asselin filter to suppress timesplitting. Most terms are managed explicitly in time, but the propagation of surface waves and vertical diffusion are implicit.

NCOM 4.0 has an orthogonal-curvilinear horizontal grid and a hybrid sigma and *z*-level grid with sigma coordinates applied from the surface down to a specified depth and level coordinates used below the specified depth. The second, newer, choice of vertical grid is a general vertical coordinate (GVC) grid consisting of a three-tiered vertical grid structure. The GVC grid is comprised of: (1) a "free" sigma grid near the surface that expands and contracts with the movement of the free surface, (2) a "fixed" sigma grid that is immobile within the free surface, and (3) a *z*-level grid that allows for "partial" bottom cells (Martin et al., 2008a,b). The relocatable version of NCOM, known as RELO NCOM, is used to generate grids and namelists of parameters for NCOM.

1.3 Earth System Modeling Framework (ESMF)

COAMPS and NCOM are integrated together through the Earth System Modeling Framework (ESMF). Funded by the Department of Defense and the National Aeronautics and Space Administration (NASA) and developed by the National Center for Atmospheric Research (NCAR), the ESMF was created as a high-performance, flexible software infrastructure to increase ease of use, performance portability, interoperability, and reuse in climate, numerical weather prediction, data assimilation, and other Earth science applications. The software infrastructure allows various weather, climate, and data assimilation components to work together on an array of platforms, from laptops to supercomputers. ESMF software is component-based, representing models as collections of smaller components that are coupled together. In ESMF, a component may be a physical domain or a function, such as a coupler or I/O system. The framework provides tools for common modeling functions, as well as regridding, data decomposition, and communication on parallel computers.

1.4 Document Overview

The purpose of this User's Guide is to describe the setup and execution of the Coupled Ocean Atmospheric Mesoscale Prediction System, Version 5.0, Rev. 1.0. COAMPS is continually undergoing enhancements and modifications, such as an upcoming wave component addition. This document represents Revision 1.0, the first of many updates to this User's Guide.

2.0 SETTING UP A SIMULATION

There are three ways to set up the COAMPS system: 1) on the local workstation, 2) on the Grid Engine, which is the shared network of computers used to run jobs locally at NRL-SSC, or 3) at the DoD Supercomputing Resource Center (DSRC). The quickest and most efficient way to run COAMPS is at the DSRC. This allows the program to automatically grab the input data from *NEWTON*, the data archive server at the NAVOCEANO DSRC, and place them in the proper directories specified by the ***setup_navy_dsrc*** script. If running COAMPS at the DSRC, the directory structures of any user are the same. If running on the local workstation or Grid Engine, COAMPS will grab the necessary files from *NEWTON* and send them to the directories the user specifies in ***setup_nrlssc*** (See Section 2.2.1.2.1).

IMPORTANT: Section 2.2.1 describes the ***setup_nrlssc*** script for running on the local workstation or Grid Engine. However, the ***setup_navy_dsrc*** script for running COAMPS on the DSRC should *only* require two minor alterations (See Section 2.2.3). The input and output directories specified in the ***setup_navy_dsrc*** script *will be the same* for all users. Section 2.2.1 is for alterations on the ***setup_nrlssc*** script *only*!

2.1 Initial Setup

When setting up a new domain, locate the new run script and namelist files on the new run system branch of the subversion repository (See Section 2.1.1 below). A COAMPS directory must be generated where the new domain's project will be created. After a COAMPS directory is established, execute the following commands to download the new scripts and namelists from the subversion control:

```
cd   [your COAMPS directory]
svn co http://coamps.nrlmry.navy.mil:8000/svn/run-coamps5/branches/ssc
sscrun
```

Several directories (including **jobs/**, **projects/**, **and scripts/** directories) have now been created in the COAMPS directory. The next step is to setup a project in the newly created directories. Create a name for the project, typically based on the geographic region, e.g. `Adriatic`, and execute the following commands from the COAMPS directory (***[region]*** refers to the project name):

```
cd sscrun
cp –a jobs/area  jobs/[region]
cp –a projects/area projects/[region]
```

Several setup scripts have now been copied from the generic **jobs/area** directory to the **jobs/[region]** directory. Project namelist and OCARDS files have been copied from the generic **projects/area** directory to the **projects/[region]** directory.

If running on the Grid Engine, the environment must be set, whether using bash or csh. In the **.bashrc** or **.cshrc** file found in the user's home directory, please assure that the following is specified in the file (change or copy it verbatim into the file):

```
#Grid Engine if[-e /u/sge/default/common/settings.sh]; then
    source "/u/gridengine/default/common/settings.sh"
```

2.1.1 COAMPS Subversion Repository

COAMPS developers at NRL routinely make changes, improvements, and bug fixes to the model, often concurrently. Therefore, they have created a COAMPS subversion repository (http://subversion.tigris.org/; Collins-Sussman et al., 2007), whereby different versions of COAMPS and its complete developmental history are stored and available for user access. The internet address for the repository is http://coamps.nrlmry.navy.mil:8000/svn/run-coamps5/branches/ssc. For web browser (read-only) viewing, via WebSVN, the repository is available at https://www7320.nrlssc.navy.mil/svn/websvn.

The subversion repository is accessible to Naval Research Laboratory-Stennis Space Center (NRL-SSC) personnel as well as to select DoD IP addresses outside the NRL-SSC system, such as the High Performance Computing Modernization Program (HPCMP) DSRC platforms. A user account must be requested from and created by Tim Campbell (tim.campbell@nrlssc.navy.mil). Send Dr. Campbell a digitally signed email request and he will reply with an encrypted email containing a username and initial password. After receiving the initial password, go to https://www7320.nrlssc.navy.mil/svn/websvn and click on the "Change Your SVN Password" link to change the password.

2.1.2 Setting/Checking Parameters

Only parameters specific to the setup of a new COAMPS simulation are mentioned in this User's Guide. There are many other namelist parameters that may be specified in both NCOM and COAMPS. Refer to the NCOM Version 4.0 User's Manual (Martin et al., 2008b) and the COAMPS User's Manual (Chen et al., 2003), respectively, for lists of those parameters. A list of common parameters is provided in Appendix F.

2.2 Creating a Directory Structure

2.2.1 Customizing the **setup_nrlssc** *Script*

The **setup_nrlssc** script, located in the **jobs/[region]** directory, is a COAMPS platform setup for the NRL's AMD64 platform, on either the Grid Engine or a local workstation. It establishes data directories for the simulation, sets the platform-specific variables utilized in the **run_coamps** script, and creates platform-specific settings output to stdout. It is invoked by the **run_coamps** script. IMPORTANT: All directories in the **setup_nrlssc** script must have correct permissions set (read and/or write).

Several of the **setup_nrlssc** script commands must be manipulated in order to establish the necessary data directories for a new run. Instructions will proceed from the beginning of the script to the end. A sample **setup_nrlssc** file is shown in Appendix A. There are no input parameters necessary. Table 1 summarizes the required global variables and those created in this script.

Table 1: Global variables required and created for setup_nrlssc.

Required global variables	
Variable	**Description**
HOME	Path to user's home directory (environment).
jobDir	Path to **jobs/** directory (where ***run_coamps*** is invoked).
cmdLog	Batch command log file (with path).
area	Name of simulation area/experiment.
ddtg	Date-time-group of run.
total_nprocs	Total number of processors.
atmos_nprocs	Number of processors for the atmospheric model.
ocean_nprocs	Number of processors for the ocean model.
Created global variables	
Variable	**Description**
batch	Batch submission command.
binDir	Full network file system (NFS) path to the COAMPS bin directory.

2.2.1.1 Defining the Kerberos User Name

The first step in tailoring the **setup_nrlssc** script for a new simulation is to locate the Kerberos user name command:

```
typeset kuser="tasmith"
```

The user must change *kuser* to match his/her Kerberos user name. This is necessary if input data must be downloaded from the DSRC.

2.2.1.2 Choosing the Input Data Directory Path

```
typeset inpDataDir= "/u/COAMPS/input"
```

The directory ***inpDataDir*** houses all the input data (NOGAPS, ADP (atmospheric data), OCNQC (oceanographic data), and GNCOM (global NCOM)) for a simulation. This is a common directory for all users at NRL-SSC. Non NRL-SSC users wishing to run COAMPS locally should set up a data archive with sufficient space for storing input data. While the ***inpDataDir*** is no longer included in the **setup_nrlssc** script, all users at NRLSSC running the **run_retrieve** script will have their chosen datasets sent to this directory. The **run_retrieve** script searches for the input data (NOGAPS, ADP, OCNQC, and global NCOM) first in **/u/COAMPS/input**. If the data is not there, the script retrieves it from *NEWTON* and places it there.

2.2.1.2.1 Gathering Input/Output Data from *NEWTON* to the Local Workstation

When running COAMPS on the DSRC, the input data will automatically be grabbed from *NEWTON*. When working on a local workstation or Grid Engine, perform the following steps:

1. Open the **setup_nrlssc** script in the **jobs/[PROJECT NAME]** directory. The UNIX command `vi` can be used to open the script.

```
vi setup_nrlssc
```

2. Under the "**Local Variables**" heading, there are paths defined for the output and save directories, ***outDataDir*** and ***savDataDir***, respectively. Define an output directory where all output will be stored. Quotations must be used before and after the directory path. For example, the author's output data is stored on his server **adept**.

```
outDataDir = "net/adept/export/data/COAMPS5/data"
```

   Output data for the run "Adriatic" , for example, will be sent to the following directories:

   Atmospheric data: ***outDataDir/Adriatic/atmos***
   Ocean data: ***outDataDir/Adriatic/ocean***
   Global NCOM cutouts: ***outDataDir/Adriatic/cutout/***

3. The save directory, ***savDataDir***, will be used to store certain data files for use by COAMPS. Example:

```
savDataDir="net/adept/export/data/COAMPS5/save"
```

4. Input data necessary to run the coupled COAMPS system, including ADP, OCNQC, NOGAPS, and global NCOM files, can be obtained from the HPC server

NEWTON. The **run_retrieve** script in ***/u/COAMPS/input/bin*** allows the user to grab the data. The following are the archive paths on *NEWTON* for the ADP, OCNQC, NOGAPS, and global NCOM data.

For ADP: `/u/home/hodur/adp`
For OCNQC: `/u/home/nachamki/ocnqc`
For NOGAPS: `/u/home/hodur/masfnmc`
For Global NCOM:
Global NCOM data is located in several directories on *NEWTON*, depending on the year of the data. Find ***gncomArchiveOutDir*** in the paths and archive commands section in **setup_nrlssc** and change the directory to point to the correct directory depending on the year of the data.

For files from 20080117 or later:

```
/u/d/ooc/data/ncom1/glb8_3b/output/ YYYYMMDD/
```

For files from 2003 (20031001 –20031231), 2004, 2005, and 2006:

```
/u/d/ooc/data/ncom1/glb8_2f/output/YYYY/YYYYMMDD
```

For files from 2007 and 2008 (20080101 –20080116):

```
/u/d/ooc/data/ncom1/glb8_2f/output/YYYYMMDD
```

2.2.1.2.1.1 Running the run_retrieve Script

1. Open a terminal window then cd into the directory `/u/COAMPS/input/bin`
2. Using Kerberos, login to HPC.
3. Execute **run_retrieve** using the following command:

```
run_retrieve  -d3  -g3 [beginning DTG] [ending DTG]
```

Example: `run_retrieve –d3 –g3 2003020100 2003022100`

The `-d3` and `-g3` options request all the data that is necessary. If the data already exists in the ***/u/COAMPS/input*** directory then the retrieval is skipped.

2.2.1.3 Choosing the Output Data Directory Path

The ***outDataDir*** houses the output data from both the atmospheric and ocean components of COAMPS. Choose a storage location with enough memory space to house all the output data. The following is an example of a path to the local COAMPS output data directory. The ***net/adept*** directory must be changed to suit the user's directory preferences for data storage.

```
typeset outDataDir= "/net/adept/export/data/COAMPS5/data"
```

2.2.1.4 Setting the Local COAMPS Save Data Directory

```
Typeset savDataDir= "/net/adept/export/data/COAMPS5/save"
```

The save directory will house the RELO NCOM tar file containing the initial and boundary conditions for the ocean model for use by COAMPS. Instructions for generating the tar file are found in Section 2.5.

2.2.1.5 The Batch Submission Command

The batch submission command (`batch =”qsub”)` is used for running COAMPS on the Grid Engine. To run COAMPS on the local workstation, simply comment the batch command (#). However, for the local workstation the number of processors used must be changed in the **setup_area** script in the ***jobs/[region]*** directory.

2.2.1.6 Selecting the Bin Directory Path

```
binDir= "/u/COAMPS/src/coamps${coampV}/bin”
```

The ***binDir*** is a full NFS path to the COAMPS bin directory. It points to the executables used in COAMPS. This is a common directory for all COAMPS users at NRL-SSC. Please do not alter it.

2.2.1.7 Creating the Path to Necessary Databases

The ***databaseDir*** houses input data such as bathymetry and terrain data files. This is a common directory for all users. Please do not alter it.

```
databaseDir=/u/COAMPS/input/database
```

2.2.1.8 Creating the Tropical Cyclone Warning Database Path

Tropical cyclone information is housed in this directory.

```
tcDir=/u/COAMPS/TCWarnings
```

2.2.1.9 Setting the Path for NOGAPS and ADP Input Files

The ***fandaDir*** is the path to the input NOGAPS (f) and input ADP files. The NOGAPS files are used as the initial boundary condition (IC) while the ADP files contain data used in the atmospheric data assimilation. The NOGAPS and ADP tar files needed for a particular project must be downloaded from *NEWTON* at the DSRC to this exact directory.

```
fandaDir=/u/COAMPS/input/fanda
```

For NRLSSC, all the NOGAPS and ADP files retrieved from *NEWTON* using the **run_retrieve** script will be housed in this location. It must not be altered because every user will have access to it after it has been downloaded from *NEWTON* once. NOGAPS files are found in the following directory on *NEWTON*:

```
/u/home/hodur/masfnmc
```

The ADP files are found in the following directory on *NEWTON*:

```
/u/home/hodur/adp
```

Please check to see if a file is offline before attempting to download using the `kftp` command. If the **run_retrieve** script is having trouble downloading a file from *NEWTON*, check to see if the file needs to be "staged" from tape first using the `sls` and `stage` commands. Use the command

```
sls –D [filename]
```

to check if the NOGAPS file is offline. It offline, restore it using the command

```
stage –w [filename].
```

The NOGAPS tar files must then be extracted in the ***fandaDir***. The `tar –xf` command is used to extract each tar file, which will automatically produce the ***f$dtg*** directories used by the model.

Each individual ADP tar file must be placed in a directory named ***adp$dtg*** ($dtg being of the form YYYYMMDDHH). NOTE: *This is not done automatically when extracting each ADP file*. First create the ***adp$dtg*** directory in the ***fandaDir***, place the ADP tar file in the ***adp$dtg*** directory, and then execute the extraction using both gunzip and tar xf.

Grab each 12-hourly 00 and 12 hr NOGAPS file for each DTG and each 00 and 12 hr ADP file for each DTG. The six-hour NOGAPS files are also included in the 00 and 12 hr NOGAPS.

Important Note: Access to NOGAPS and ADP data requires the group permission of NRL code NRLMR0024 (James Doyle's group at NRL in Monterey, CA (NRLMRY). If permissions are needed, please send an email request to james.doyle@nrlmry.navy.mil stating, as a COAMPS user, the need for access to data.

2.2.1.10 OCNQC Data Path Selection

The ***ocnqcDir*** houses the OCNQC data used by NCOM for the ocean analysis and data assimilation:

```
ocnqcDir=/u/COAMPS/input/ocnqc
```

For NRLSSC, all the OCNQC files retrieved from *NEWTON* using the **run_retrieve** script will be housed in this location. It must not be altered because every user will have access to it after it has been downloaded from *NEWTON* once. Download the OCNQC files necessary from the following directory on *NEWTON*:

```
/u/home/nachamki/ocnqc.
```

Extract the OCNQC tar files in the ***ocnqcDir***. Be aware that the OCNQC data is not essential to coupling, since the data is only used to generate the initial SSTs for the atmospheric model from within the bootstrap step. The bootstrap step is just one time step of the atmospheric model and is necessary to create the initial atmospheric analysis fields. The bootstrap step uses NCODA SSTs for these initial fields only in a fully coupled COAMPS run. All subsequent time steps following the bootstrap step use NCOM SSTs. However, the OCNQC data is absolutely necessary for atmosphere-only model runs.

Important Note: Access to OCNQC data requires the group permission of NRL code NRLMR0024 (James Doyle's group at NRL in Monterey, CA (NRLMRY). If permissions are needed, please send an email to james.doyle@nrlmry.navy.mil requesting, as a COAMPS user, the need for access to data.

2.2.1.11 Global NCOM Data Path Selection

The ***gncomDir*** (/u/COAMPS/input/gncom) will contain the global NCOM data that is downloaded from the **run_retrieve** script for the ocean boundary conditions. The **ovgrd_1.D** and **ohgrd_1.A** files are found in ***gncomArchiveInpDir***, utilized by the global NCOM cutout program, and placed in ***gncomDir***. The NCOM cutout program creates the SST fields from global NCOM for initializing the ocean model (NCOM) for the region of interest.

Depending on the DTGs specified, the **run_retrieve** script will grab the **out3d** files (**out3d_1_YYYYMMDDHH.A**) that run the global NCOM cutout program from the following directories on *NEWTON* and place them in the ***gncomDir***:

```
/u/d/ooc/data/ncom1/glb8_3b/output/YYYYMMDD/
```

for files from 20080117 or later, or

```
/u/d/ooc/data/ncom1/glb8_2f/output/YYYY/YYYYMMDD/
```

for files from 2003 (20031001 - 20031231), 2004, 2005, and 2006, or

```
/u/d/ooc/data/ncom1/glb8_2f/output/YYYYMMDD/
```

for files from 2007 and 2008 (20080101 - 20080116).

If running COAMPS on the local workstation or Grid Engine, the **run_retrieve** script will copy the global NCOM files from *NEWTON* to the user specified ***gncomDir***. If running COAMPS at the DSRC (e.g. *BABBAGE, DAVINCI, or EINSTEIN*), the global NCOM files will be copied to ***/scr/[user]/COAMPS/data/gncom***. The global NCOM cutout program creates a directory in ***gncomDir*** named ***$AREA.$dtg*** that will contain the actual cutout files.

```
gncomDir=$inpDataDir/gncom
```

***NOTE:** For each $dtg, download the next 12-hour **out3d** files. For example, if a run begins on 2003020900, use the **out3d_1_2003020900.A**, **out3d_1_2003020906.A**, and **out3d_1_2003020912.A** files.

2.2.1.12 Setting Paths to Model Output Data Files

The ***atmosDir***, ***oceanDir***, ***obkgdDir***, and ***cutoutDir*** directories are the output data file paths for the atmosphere and ocean models. The output data will go in the following directories depending on the user's specifications for ***outDataDir*** earlier in the script.

```
# paths to model output data
     atmosDir=$outDataDir/$area/atmos
     oceanDir=$outDataDir/$area/ocean
```

```
    obkgdDir=$outDataDir/$area/obkgd
    cutoutDir=$outDataDir/$area/cutout
```

2.2.1.13 *Archive Copy Commands and Paths*

The ***gncomArchive*** directories house the global NCOM input and output files. These are common to all users at NRL-SSC.

```
# run archive copy command and archive path
      saveDir=$savDataDir/$area
      archiveCopyCmd=cp
      archiveDir=$savDataDir/$area

# gncom archive copy command and archive path
# (don't include dtg dependence in path, this is handled by retrieve
function)
      gncomCopyCmd=krcp
      gncomArchiveInpDir=$kuser@newton:/u/d/ooc/data/ncom1/glb8_2a
  gncomArchiveOutDir=$kuser@newton:/u/d/ooc/data/ncom1/glb8_2f/output
```

2.2.1.14 *Input Data Archive Commands and Paths*

The archive directories listed below are specified if input data is not downloaded manually. These are archive copy commands and archive paths for NOGAPS, ADP, and OCNQC data. Please do not alter them.

```
     # nogaps archive copy command and archive path
     nogapsArchiveCopyCmd=kscp
     nogapsArchiveDir=$kuser@newton:/u/home/hodur/masfnmc

     # adp archive copy command and archive path
     adpArchiveCopyCmd=kscp
     adpArchiveDir=$kuser@newton:/u/home/hodur/adp

     # ocnqc archive copy command and archive path
     ocnqcArchiveCopyCmd=kscp
     ocnqcArchiveDir=$kuser@newton:/u/home/nachamki/ocnqc
```

2.2.2 Customizing the **setup_area** *Script*

In the ***jobs/[region]*** directory, the **setup_area** file is used to setup specific run parameters for the simulation. Within this script, the user must specify both the site (DSRC or local) and the platform (*BABBAGE. DAVINCI*, *EINSTEIN*, or local machine) on which COAMPS is being run.

`site=navy_dsrc` (for DSRC usage)
`site=nrlssc` (for local NRLSSC usage)

`platform=babbage`, `davinci`, or `einstein` (for DSRC usage)
`platform=[local machine]` (for local workstation usage)
`platform=xeon(`for running COAMPS on the grid engine at NRL-SSC)

Table 2 summarizes the global variables created during the running of the script, however, there are no global variables or input parameters required. Step-by-step instructions on the various script commands requiring user intervention proceed from the beginning of **setup_area** to the end. A copy of the **setup_area** file is found in Appendix B. The script is subject to change depending on the frequency of the input data specified (3- or 6-hourly), the number of processors, and other factors that impact the model run.

Table 2: Global variables created for setup_area.

Created global variables	
Variable	**Description**
coampsV	Version of COAMPS being used (Version 4 or 5).
site	Location COAMPS is being run (DSRC or local machine).
platform	Name of platform (corresponds to setup_${platform}.sh).
update_cycle	Number of hours for hindcast/forecast update cycle (6 or 12 hr).
atmos_nproc(x,y)	Number of tiles in x- and y-direction for atmospheric model.
ocean_nproc(x,y)	Number of tiles in x- and y-direction for ocean model.
gatm_fcst	Global-atmospheric analysis forecast/hindcast LBC flag.
gatm_step	Frequency in hours of global-atmospheric fields.
gatm_length	End forecast hour to get global-atmospheric fields.
gatm_nlevel	Number of vertical levels in global-atmospheric fields.
gocn_fcst	Global-ocean analysis forecast/hindcast LBC flag.
gocn_step	Frequency (in hours) of global-ocean fields.
gocn_length	End forecast hour to get global-ocean fields.
ocards & xcards	Names OCARDS and XCARDS files (in ***projects/*** directory).

2.2.2.1 Choosing the COAMPS Version Number

The *coampsV* parameter specifies the COAMPS version being utilized (either Version 4 or 5). Version 5 is the default.

```
coampsV=5
```

2.2.2.2 Choosing the Update Cycle

The *update_cycle* parameter sets the hindcast/forecast update cycle. It can be set for either 6 or 12 hours. The default is 12.

```
update_cycle=12
```

2.2.2.3 Running in Concurrent or Sequential Mode

The *concurrent_cpl_mode* should be set to false ("f") when running COAMPS on a few processors such as the local workstation or Grid Engine. When set to "f", this parameter will run a coupled forecast in sequential mode, with the atmospheric and ocean models running on the same set of processors. The total # of processors = # of atmospheric processors = # of ocean processors. When running COAMPS on the DSRC, *concurrent_cpl_mode* may be set to true ("t"), which runs the atmospheric and ocean components on different sets of processors. The total # processors = # of atmospheric processors + # of ocean processors. The default is "f", and it is recommended that *concurrent_cpl_mode*=f for COAMPS on the DSRC as well.

```
concurrent_cpl_mode=f
```

2.2.2.4 Selecting the Number of Processors

Set the appropriate number of processors depending on the location of the run, whether it is the local workstation, Grid Engine, or the DSRC. The product of *nprocx* and *nprocy* equals the total number of processors being used. For this example, the total number of processors is 2(4) = 8. Please see the "`batch=qsub`" command section in the ***setup_nrlssc*** script above (Section 2.2.1.5) for running COAMPS on the Grid Engine or local workstation. COAMPS can be run with both 32 and 64 processors. COAMPS testing on *BABBAGE* has shown that 32 is the most efficient and ideal number of processors for running on *BABBAGE*.

```
atmos_nprocx=2; atmos_nprocy=4
ocean_nprocx=2; ocean_nprocy=4
```

2.2.2.5 Setting Global Atmospheric Parameters

The *gatm_fcst* parameter is the global-atmospheric analysis/forecast lateral boundary condition (LBC) flag. When setting it to "t", the global atmospheric analysis will be employed for the LBC. If setting to "f", the global atmospheric forecast will be used.

The *gatm_step* parameter is the frequency (in hrs) of the global atmospheric fields, depending on what is available for the selected DTG. The *gatm_step* parameter can be set to 6 or 12 hrs, depending on the frequency of the NOGAPS (f) data files.

The *gatm_length* parameter is the end forecast hour to get the global atmospheric fields. It should be greater than or equal to the *update_cycle* and must be set to 12 for the data assimilation 12-hour cycling.

```
gatm_fcst=f
gatm_step=6
gatm_length=12
```

2.2.2.6 Setting Global Ocean Parameters

The *gocn_fcst* parameter, if set to "t", defines the use of the global ocean forecast as the LBC. It must be set to "f" to utilize the hindcast **out3d** files from global NCOM as the LBC.

The *gocn_step* parameter is the frequency (in hrs) of the global ocean fields. As in *gatm_step*, it depends on what is available for the selected DTG. It may be set to 3 or 6 hrs, depending on the frequency of the global NCOM data for a particular project.

The *gocn_length* parameter is the end forecast hour to get the global ocean fields. It should be greater than or equal to the *update_cycle* and must be set to 12 for the data assimilation 12-hour cycling.

```
gocn_fcst=f
gocn_step=6
gocn_length=12
```

2.2.2.7 OCARDS and XCARDS Files

The OCARDS file may be generated using the **gen_ocards.ksh** script in the ***projects/[area]*** directory. An **OCARDS.default** file can be used to output certain COAMPS flat files. A user may specify certain output not generated in the **OCARDS.default** file by using the **gen_ocards.ksh** script in the ***projects/[area]*** directory. If an OCARDS file other than the default is used, please change

OCARDS.default to **OCARDS.$area** (which is generated by **gen_ocards.ksh**). The following commands name the OCARDS and XCARDS files in the ***projects/*** directory.

```
ocards=OCARDS.$area
xcards=XCARDS.$area
```

2.2.3 Customizing the setup_navy_dsrc Script

The **setup_navy_dsrc** script automatically creates a setup for the user to access *BABBAGE*, *DAVINCI*, or *EINSTEIN*, the Navy's DSRC IBM P5+ systems for job queuing and running. The script sets variables to directly pull the ADP, OCNQC, NOGAPS, and global NCOM files from *NEWTON* and put them in directories created within the script. Appendix C contains the entire **setup_navy_dsrc** script. Only two variables in **setup_navy_dsrc** require alteration by the user.

2.2.3.1 Specifying the Project Account Number

When running on the DSRC, it is necessary to enter a project account number (*projAcct*) to which the particular COAMPS run will be charged. The following command in the ***setup_navy_dsrc*** must be changed to reflect the correct account number.

```
typeset projAcct="NRLSS060"
```

The batch directive for *projAcct* is `#PBS -A ${projAcct}`.

2.2.3.2 Specifying the COAMPS Run Time

The *wallTime* is the amount of time a user may request for a COAMPS run. For example, if a 12-hour forecast takes 45 minutes then the user should request an hour of run time. The format for *wallTime* is "HH:MM:SS", so one hour would be

```
typeset wallTime="01:00:00"
```

The batch directive for *wallTime* is `#PBS -l walltime=${wallTime}`.

2.2.3.3 Checking the Status of a DSRC COAMPS Run

The user may check the status of the jobs submitted to the DSRC by using the Portable Batch System (PBS) commands. PBS is a program that allocates batch jobs among the available DSRC platforms. The following commands shown in Table 3 are evoked by simply typing them at the command prompt.

Table 3: Portable Batch System (PBS) commands for checking the status of a COAMPS run on the DSRC.

Command	Description
`qstat`	Shows the status of all running and pending jobs.
`qstat –u [username]`	Shows the status of current jobs.
`qpeek [job ID number]`	Displays the progress of the COAMPS run.
`qdel [job ID number]`	Kills a job in progress.

2.3 Setting up Atmospheric and Oceanic Namelists

The following namelist files are necessary for the COAMPS setup. These namelist files are located in ***[COAMPS directory]/sscrun/projects/[region]***.

setup_esmf_config
gridnl_atmos
gridnl_ocean
setup_ncom_env
setup_ncom_spmd
setup_nl_aeronl
setup_nl_atmosnl
setup_nl_coamnl
setup_nl_cutout
setup_nl_dsetnl
setup_nl_gtau
setup_nl_idealized
setup_nl_MVOInl
setup_nl_nrplnl
setup_nl_oanl
setup_nl_omapnl
setup_nl_omnl
setup_nl_omnloff
setup_nl_oparm
setup_nl_soilnl
OCARDS.tcfcst
OCARDS.default
gen_ocards.ksh

The OCARDS files output data specified by the user. The script **gen_ocards.ksh** in the namelist directory is an OCARDS generation script that allows the user to create hourly output for several important variables on a specified grid, such as winds, wind stress, and heat fluxes. Run the **gen_ocards.ksh** script for the specific project to generate the atmospheric flat file output.

2.3.1 COAMPS Atmospheric Namelist Setup

2.3.1.1 Choosing the Atmospheric Nests and Levels

After generating the atmospheric grid setup for COAMPS using COAMPS On-Scene (COAMPS-OS) (See Section 2.6 for stepwise instructions on using the COAMPS-OS® GUI on *FORD* at NRL-SSC), transfer the grid setup (***gridnl***) to ***gridnl.atmos***. The number of nests is specified in the parameter *nnest*. This parameter may be changed to any number of nests less than the total number of nests originally specified without making changes to the namelist. The number of atmospheric levels, *kka*, is currently set to 40. The *kka* values may be set to 30, 40, or 60 levels. The correct sigma level specifications (for *dsigma*) are automatically chosen depending on the value of *kka* in ***gridnl_atmos*.**

2.3.1.2 Selecting Boundary Condition and MVOI Levels (setup_nl_atmosnl)

The atmospheric namelist, ***setup_nl_atmosnl***, is important for setting up the boundary condition (BC) levels and number of MVOI levels. Currently, for the MVOI used in the data assimilation, the *lm* parameter must be set to a value of 16, because MVOI is only applicable for 16 levels.

The parameter *lmbc* (the number of boundary condition levels) changes depending on the NOGAPS data of the hindcast. For the Adriatic test case of February 2003, *lmbc* was set to 26 based on the number of NOGAPS BC levels. Simulations with newer data sets may require that *lmbc* be set to 27 to match the number of NOGAPS boundary condition levels. This parameter is automated to read the NOGAPS files and determine the number of levels necessary to run COAMPS.

2.3.1.3 Setting COAMPS-Specific Parameters (setup_nl_coamnl)

In ***setup_nl_coamnl***, most of the parameters are set to their optimum default values. However, several parameters have been added or changed. One of the more important parameters, *delta,* specifies the time step for the atmospheric model. It is useful in tweaking the model run and customizing it to the user's needs. The default is set to 90 seconds.

The parameter *l2way* controls feedback between nests. It is currently set to "f". This may change in the near future. The parameters *njump* and *nradtyp* refer to the radiation scheme type used by the atmospheric portion of COAMPS. Parameter *nradtyp* is currently set to 1; however, a new radiation scheme, Fu-Liou, is in the process of being tested. When completed, *nradtyp* will need to be set to a value of 2. Parameter *njump* will currently remain at 1. Once *kka,* which sets the number of atmospheric levels, is specified in ***setup_nl_atmosnl***, commenting or uncommenting lines in the ***setup_nl_coamnl*** script becomes unnecessary.

2.3.2 NCOM Oceanic Namelist Setup

2.3.2.1 Ocean Grid Parameter Setup (gridnl.ocean)

After generating the ocean grid namelist (***gridnl***) in RELO NCOM (See Section 2.5), transfer the grid information to ***gridnl.ocean***. The number of ocean nests is specified in *nnest*. As with the atmospheric ***gridnl*** namelist, the nest number may be changed to a number less than the original setup. For example, if the original setup on RELO NCOM was for two nests, changing *nnest* to 1 will not require any additional changes to the namelist.

2.3.2.2 Ocean Parameter Setup (setup_nl_oparm)

In the ***setup_nl_oparm*** ocean namelist, parameter *dti_base* is the time step for ocean nest 1. The time step for ocean nest 2 will automatically follow a 3:1 ratio to the nest 1 time step. The parameter, *indiag*, prints out diagnostics to the screen. Change *indiag* to 1 for more diagnostics. The river input parameter, *indriv*, is set to 1, for "on". Change *indriv* to 0 to turn off river input.

2.3.2.3 Miscellaneous Ocean Parameter Setup (setup_nl_omnl)

In the ***setup_nl_omnl*** ocean namelist, parameter *kkso* is the number of sigma levels used in NCOM. The default value is set at 18. However, RELO NCOM uses 35 levels as its default setting, so the recommended value for *kkso* is 35, especially if RELO NCOM ICs and BCs are being used.

2.4 ESMF Configuration (*setup_esmf_config*)

In the ***projects/[region]*** directory, the **setup_esmf_config** script specifies the type of coupling (one-way, two-way, none) and the coupling interval between the atmospheric and ocean models. Appendix D provides a copy of the script.

The parameter *cpl_sec* specifies the coupling interval for COAMPS in seconds. The time interval must be divisible by the time step of both the atmospheric and ocean models. The default value is currently set at 360 seconds (6 min). The parameters *couple_a2o* and *couple_o2a* specify a coupled forecast with atmosphere-to-ocean exchange or ocean-to-atmosphere exchange. The parameter *ocean_export_init_only* specifies whether only the initial fields are exchanged in the coupling (set to "t") or the time-varying ocean fields are exchanged (set to "f"). This parameter is also important for performing uncoupled runs. This option is only valid for *couple_o2a*=t. The following possibilities exist:

- For a fully coupled run, *couple_a2o* and *couple_o2a* must be set to "t" and *ocean_export_init_only* must be set to "f".
- To specify an uncoupled run but still provide COAMPS wind forcing to NCOM, set *couple_a2o* to "t" and *couple_o2a* to "f".
- By setting *couple_a2o* to "t", *couple_o2a* to "t", and *ocean_export_init_only* to "t", only the initial tau=0 fluxes computed from NCOM SSTs will be used at each coupling interval. NCOM SSTs and fluxes will not be updated within the forecast.
- For one-way coupling, set the appropriate parameter to "t" and set the alternate one to "f". For no feedback, set both *couple_a2o* and *couple_o2a* to "f".

2.5 NCOM Nests Setup using RELO_NCOM

The NCOM nest configuration program in COAMPS, **ncom_config.f**, is available for multiple NCOM nesting by using the *local* RELO NCOM initial and boundary conditions instead of those created by COAMPS. **IMPORTANT NOTE:** It is imperative for the user to understand that using RELO NCOM to generate initial and boundary conditions for NCOM is currently the *only* method available. Set the parameter *locean*=f in ***setup_nl_gtau***. In the near future, the RELO NCOM setup will be included within COAMMPS5, rather than as an external function. Once COAMPS is available to generate the initial and boundary conditions for NCOM, *locean* will need to be set to "t" in ***setup_nl_gtau***.

2.5.1 Setting up the RELO NCOM Environment

Important: RELO NCOM must have been previously run on the user's workstation before beginning these steps. If it has not been previously run, send an email message to Clark Rowley at NRL-SSC (clark.rowley@nrlssc.navy.mil) for assistance in setting up RELO NCOM for use with COAMPS.

1. In the RELO NCOM directory (e.g. ~/NCOM), locate the **setup.csh** file or **relo.csh** file. The correct version of RELO NCOM must be specified in the **relo.csh** file.

```
setenv RELO
/net/dynamic/export/data/Rowley/models/relo/relo.rev145
```

2. Set the ***scrDir*** directory where RELO NCOM output will be stored.

   `setenv SCRDIR` [directory where output will be stored]

3. Set the ***static*** directory where RELO NCOM project directories are created.

   `setenv STATIC` [directory where NCOM project directory is located]

4. Make sure **$RELO/RELO.sch** is sourced in the **relo.csh** file.

```
$RELO/RELO.csh
```

5. Save and exit the **relo.csh** file and then source this file at the prompt.

```
source relo.csh
```

6. Set the environment for the region and beginning DTG for RELO NCOM.

```
setenv REGION [region name]
setenv CRDATE [beginning dtg]
```

2.5.2 *Preparing the RELO NCOM Input*

1. Setup the location and resolution of the ocean nests by invoking the following command:

   ```
   $RELO/script/prep_inputs.pl
   ```

2. Respond to the following series of setup requests below ("y" is yes and "n" is no):
   a. Enter the region name.
   b. Enter the initial DTG (date-time-group; YYYYMMDDHH).
   c. Enter the first analysis DTG (typically the same as the initial DTG).
   d. Make a directory in the RELO NCOM directory? (choose "y")
   e. Modify the parameters? Choose "y". A series of parameters will appear on the screen. Modify the following parameters in the LINUX view program, *vi*:
      - FCSTHR (The total number of hours for the COAMPS run)
      - N_NEST (Change to "2" for two ocean nests, if necessary)
   f. Run with tides added to the NCOM lateral BCs? (choose "y")
   g. Apply the tidal potential in NCOM? (choose "y")
   h. Run with river fluxes turned on? (choose "y")
   i. Enter the southwest corner longitude of nest 1 (use negative values for degrees West).
   j. Enter the southwest corner latitude of nest 1 (use negative values for degrees South).
   k. Enter the northeast corner longitude of nest 1.
   l. Enter the northeast corner latitude of nest 1.
   m. Enter the resolution in kilometers (nest 1 is typically a factor of three larger than nest 2. **NOTE:** If specifying a nest that is *less than* or *equal to* 1 km, specification must be in meters (m).
   n. Enter the timestep in seconds (Press "Enter". This is not needed for setup).
   o. Repeat steps *i* through *n* if two nests were specified.
   p. Do setup over again? Choose "n" or "y".
   q. View the namelist file? Choose "n" or "y".
   r. Display the namelist file? Choose "n" or "y".
   s. View the met_forcing file? Choose "n".

3. View the NAVOCEANO post_processing namelist setup? Choose "n".

After this setup is complete, go into the ***REGION*** directory created in the RELO NCOM directory. Check the **relo.nl** file created by RELO NCOM (`cd REGION`; `vi relo.nl`). It is important that the correct directory paths are specified in the *hostnl* namelist. The following may be generated by RELO NCOM in the *hostnl* namelist:

```
&hostnl
add_year= .true.,
hinc = 6,
host_ncpath = 'none'
host_odimens = 'none/odimens.D',
host_ohgrda = 'none/ohgrd_1.A',
host_ohgrdb = 'none/ohgrd_1.B',
host_ohgrdd = 'none/ohgrd_1.B',
host_path = 'none'
host_run = 'none'
```

Please change *hostnl* to the following:

```
&hostnl
add_year = .true.,
hinc = 6,
host_ncpath = '/u/NCOM/glb8_3b/nc'(Use glb8_2f
if run is in 2007 or before)
host_odimens =
'/u/NCOM/glb8_2a/input/odimens.D',
host_ohgrda =
'/u/NCOM/glb8_2a/input/ohgrd_1.A',
host_ohgrdb =
'/u/NCOM/glb8_2a/input/ohgrd_1.B',
host_ohgrdd =
'/u/NCOM/glb8_2a/input/ovgrd_1.D',
host_path = 'none'
host_run = 'glb8_3b' (Use glb8_2f if run is in 2007 or
before).
```

2.5.3 Configuring RELO NCOM

With this step the user must create an exchange grid and generate **oinit** files.

1. Copy the following scripts from */u/COAMPS/src/relo* into the ***REGION*** directory:

   ```
   prep_exgrd.ksh
   ```

```
prep_opnbc.ksh
```

2. Execute the following command in the ***REGION*** directory for configuring RELO NCOM:

   ```
   $RELO/script/prep_ncomconfig.pl $REGION
   ```

3. Execute the following command for creating the exchange grid:

   ```
   prep_exgrd.ksh $REGION
   ```

4. Generate the initial (**oinit**) files from RELO NCOM by executing the following command:

   ```
   $RELO/script/prep_ncomconfig.pl –reinit $REGION
   ```

*2.5.4 Generating the Boundary Condition File for Ocean Nest 1 (***opnbc***)*

To generate the boundary condition file for the entire COAMPS run (**opnbc**), execute the following steps.

1. Set the *total* number of forecast hours needed for the entire run in the **relo.env** file in the ***REGION*** directory. Set *fcsthr* to the total number of hours to be covered by the **opnbc** file. (e.g., for a 30-day run, set *fcsthr* to 720).

2. Execute the following command:

   ```
   prep_opnbc.ksh $REGION $CRDATE
   ```

2.5.5 Copying IC and BC files to the COAMPS Ocean Directory

2.5.5.1 Copying From the Local Workstation or Grid Engine

The initial and boundary conditions created by RELO NCOM must now be copied to the appropriate data directory in COAMPS.

1. Copy all o* files in the RELO NCOM/REGION/input0 directory to the ***oceanDir*** COAMPS directory.

2. Copy the **opnbc_1.D.$CRDATE** (with $CRDATE being the specific beginning DTG of the run) file from your specific RELO NCOM output directory to the ***oceanDir*** directory of COAMPS.

3. Drop the $CRDATE tag on the **opnbc** file by renaming the ***opnbc_1.D.$CRDATE*** file to **opnbc_1.D** (use the `mv` command).

2.5.5.2 Copying from DSRC Systems

If running COAMPS on *BABBAGE*, *DAVINCI*, or *EINSTEIN* at the DSRC, follow the steps below to copy the initial and boundary condition files from RELO NCOM to the appropriate directory:

1. Copy the **opnbc_1_.D.$CRDATE** (with $CRDATE being the specific beginning DTG of the run) file from the user-specific RELO NCOM output directory to the ***RELO NCOM/[region]/input0*** directory containing the o* files.

2. Rename **opnbc_1.D.$CRDATE** to **opnbc_1.D** using the `mv` command.

3. Tar up all of the o* files in the ***RELO NCOM/[region]/input0*** directory. Use the following command:

   ```
   tar cf [region].tar o*
   ```

4. Move the new **[region].tar** file from the ***RELO NCOM/[region]/input0*** directory to the ***/scr/[user]/COAMPS/save*** directory on *BABBAGE, DAVINCI, or EINSTEIN*. Use the `kftp` command to transfer this file to the selected DSRC system.

5. The location of the **[region].tar** file will be specified in the command line to run COAMPS on DSRC systems (See Section 3.2.2).

2.5.6 Checking the **locean** *Flag*

The NCOM nest configuration program in COAMPS, **ncom_config.f**, is available for multiple NCOM nesting by using the *local* RELO NCOM initial and boundary conditions instead of those created by COAMPS. Check the *locean* flag in the ***setup_nl_gtau*** namelist in the projects/REGION directory of the COAMPS setup. The *locean* flag tells **ncom_config.f** not to produce the initial and boundary conditions for NCOM because the setup from RELO NCOM is being used. With *locean*=f, **ncom_config.f** will continue to make the **obkgd** tendency files but not the initial and boundary condition files. If the nest configuration is available in the COAMPS system, set *locean*=t and add *kkom* = 50 (the total number of ocean levels) to the *gridnl.ocean* namelist in the ***projects/[area]*** directory.

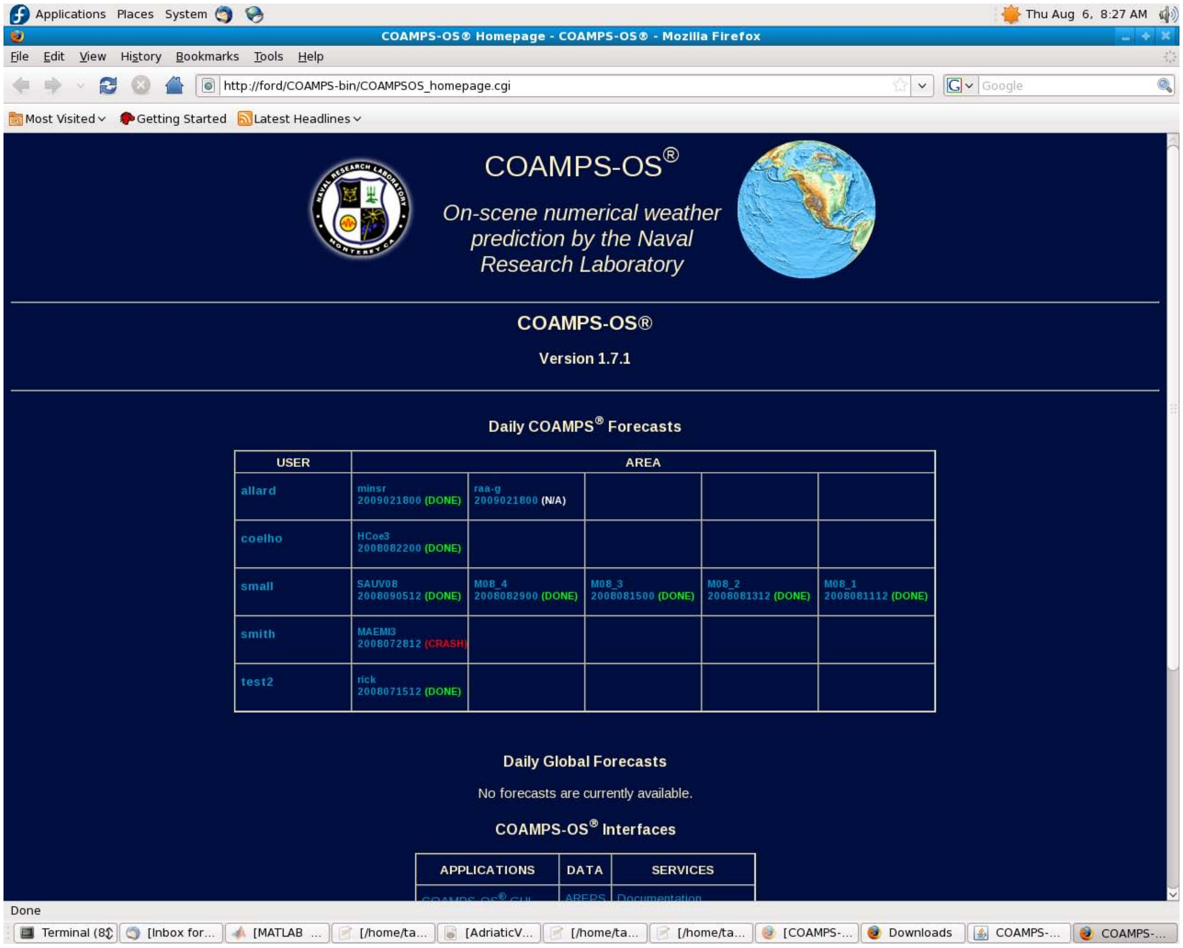
2.5.7 Starting COAMPS

Start the program with the usual commands as outlined in Section 3.1 below.

2.6 Atmospheric Nests Setup Using COAMPS-OS®

The fastest and easiest method to setup the COAMPS atmospheric grids is to use COAMPS-OS® (COAMPS ON-SCENE). In addition to the COAMPS modeling components, COAMPS-OS has web-based interfaces to configure COAMPS and access COAMPS data, automated graphical processing, and software that interacts with the Navy's Tactical Environmental Database Services (TEDS) (Geiszler et al., 2003).

A username and password are required to login to the COAMPS-OS system, and these can be obtained by contacting either Travis Smith (travis.smith@nrlssc.navy.mil; 228-688-5631) or Daniel Goolsby
(daniel.goolsby@nrlssc.navy.mil; 228-688-4707), who are both employed at NRL. At NRL-SSC, access to COAMPS-OS is available on *FORD* at http://ford/COAMPS-bin/COAMPSOS_homepage.cgi (See Figure 1). The steps below provide instructions to produce the atmospheric ***gridnl*** namelist to be transferred to the ***gridnl_atmos*** namelist in the ***/projects/[region]*** directory.



COAMPS-OS®

On-scene numerical weather prediction by the Naval Research Laboratory

COAMPS-OS®

Version 1.7.1

Daily COAMPS® Forecasts

USER	AREA				
allard	minsr 2009021800 (DONE)	raa-g 2009021800 (N/A)			
coelho	HCoe3 2008082200 (DONE)				
small	SAUV08 2008090512 (DONE)	M08_4 2008082900 (DONE)	M08_3 2008081500 (DONE)	M08_2 2008081312 (DONE)	M08_1 2008081112 (DONE)
smith	MAEMI3 2008072812 (CRASH)				
test2	rick 2008071512 (DONE)				

Daily Global Forecasts

No forecasts are currently available.

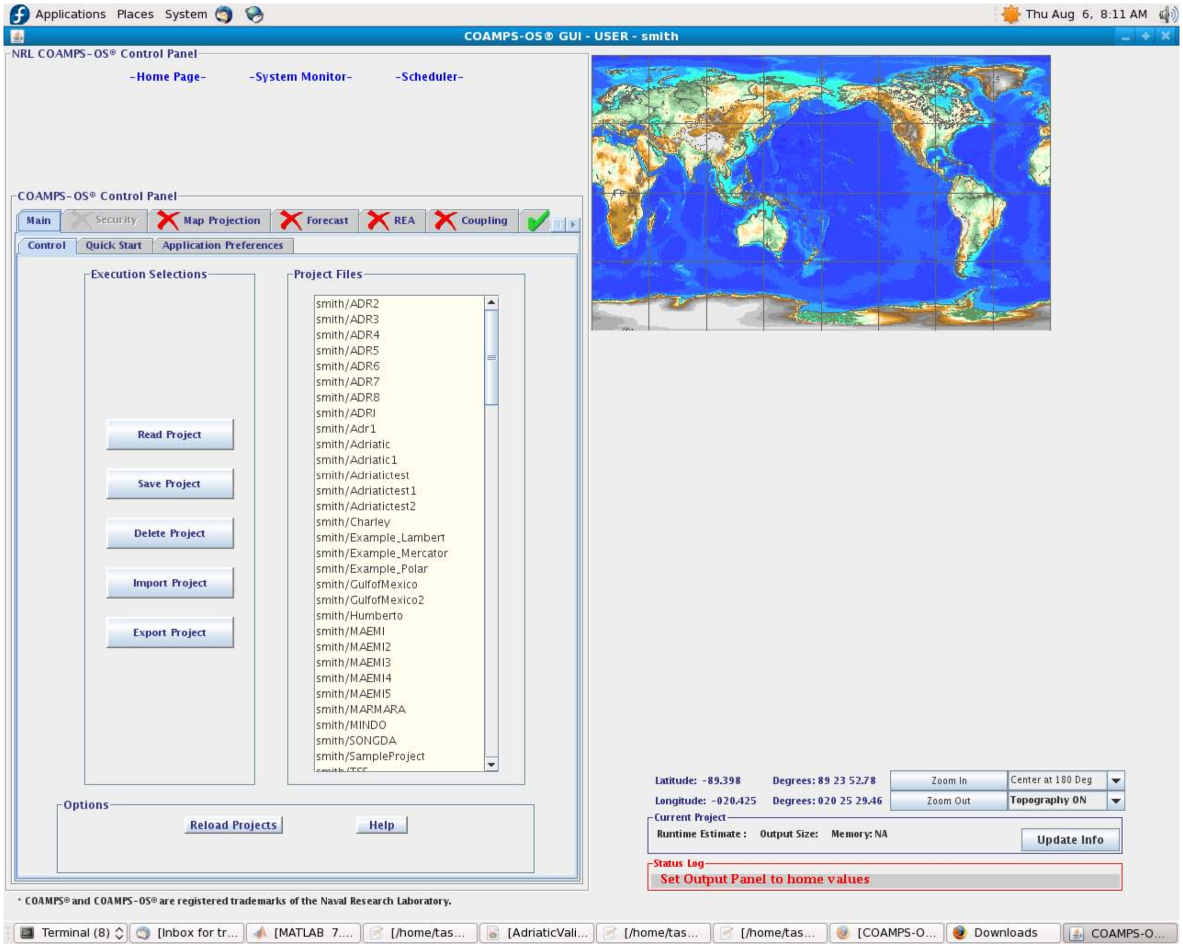
COAMPS-OS® Interfaces

APPLICATIONS	DATA	SERVICES
COAMPS-OS® GUI	AREPS	Documentation

Figure 1: COAMPS-OS Homepage on *FORD*.

2.6.1 Defining the Grids

After logging on to COAMPS-OS, click the general area on the world map where the grids will be setup (See Figure 2). Two grids will appear in the area that was chosen, an outer grid (white) and an inner grid (yellow). To zoom into the area, click and drag a box around the area of interest and then click the **Zoom In** button below the map.



smith/ADR2
smith/ADR3
smith/ADR4
smith/ADR5
smith/ADR6
smith/ADR7
smith/ADR8
smith/ADRI
smith/Adr1
smith/Adriatic
smith/Adriatic1
smith/Adriatictest
smith/Adriatictest1
smith/Adriatictest2
smith/Charley
smith/Example_Lambert
smith/Example_Mercator
smith/Example_Polar
smith/GulfofMexico
smith/GulfofMexico2
smith/Humberto
smith/MAEMI
smith/MAEMI2
smith/MAEMI3
smith/MAEMI4
smith/MAEMI5
smith/MARMARA
smith/MINDO
smith/SONGDA
smith/SampleProject

Latitude: -89.398 Degrees: 89 23 52.78

Longitude: -020.425 Degrees: 020 25 29.46

Runtime Estimate : Output Size: Memory: NA

Set Output Panel to home values

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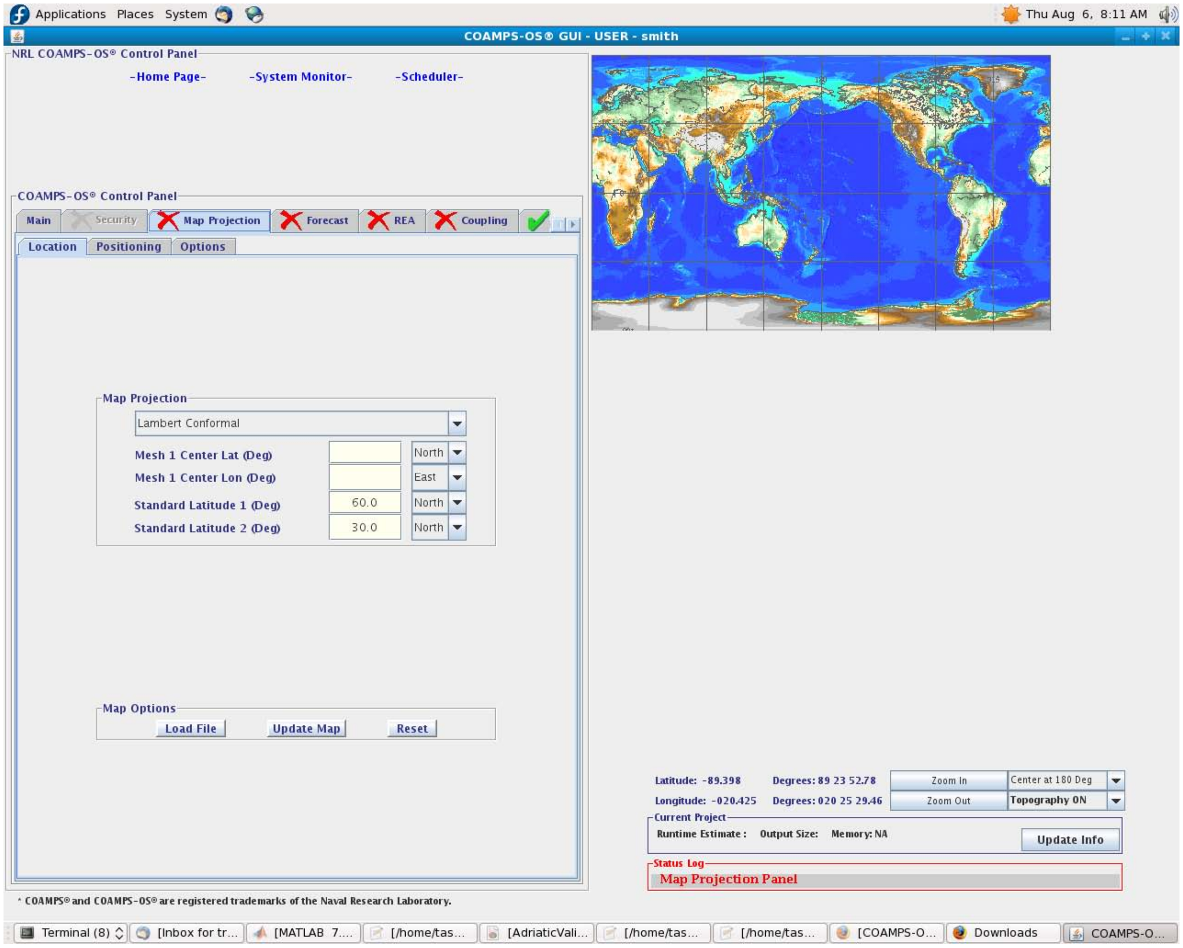
Figure 2: COAMPS-OS Main GUI Page.

2.6.2 Configuring the Nests

To adjust the size, location, projection, and number of nests, click on the **Map Projection** tab in the COAMPS-OS Control Panel. There are three tabs within the Map Projection section: **Location**, **Positioning**, and **Options**.

2.6.2.1 Choosing a Map Projection

Click on the **Location** Tab (See Figure 3). Choose the desired map projection (Mercator, Lambert Conformal, Polar Stereographic, or Spherical). Lambert Conformal can only be used between 20 and 70 degrees of latitude. If a nest is partially located south of 20°N (Northern Hemisphere), the Mercator projection will automatically be chosen.



Map Projection

Lambert Conformal

Mesh 1 Center Lat (Deg) North

Mesh 1 Center Lon (Deg) East

Standard Latitude 1 (Deg) 60.0 North

Standard Latitude 2 (Deg) 30.0 North

Latitude: -89.398 Degrees: 89 23 52.78

Longitude: -020.425 Degrees: 020 25 29.46

Center at 180 Deg

Topography ON

Current Project

Runtime Estimate : Output Size: Memory: NA

Status Log

Map Projection Panel

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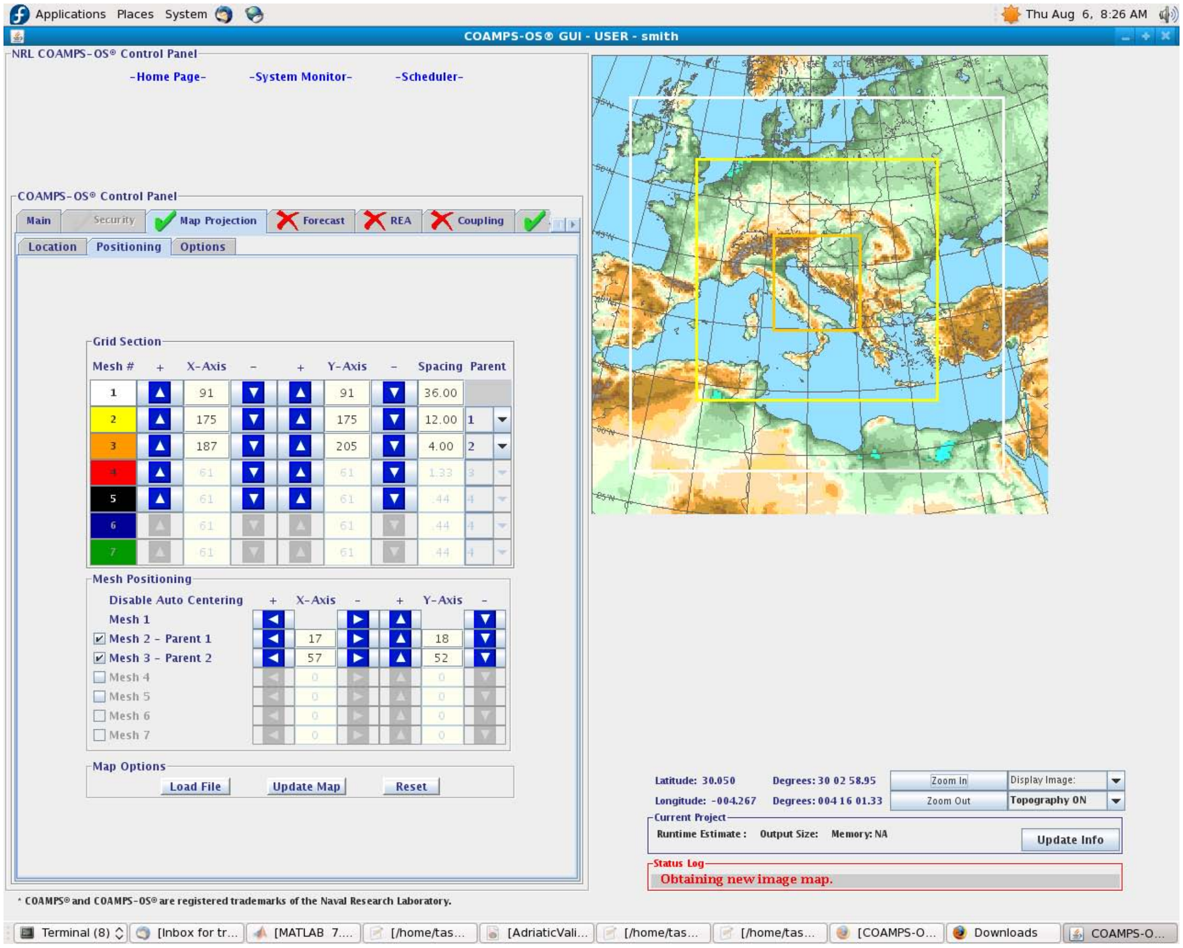
Figure 3: COAMPS-OS Map Projection tab, showing the Location tab options.

2.6.2.2 Optimizing Nests

The **Positioning** tab is used to adjust the number, resolution, size, and position of each nest (See Figure 4).



Grid Section

Mesh #	+	X-Axis	–	+	Y-Axis	–	Spacing	Parent
1	▲	91	▼	▲	91	▼	36.00	
2	▲	175	▼	▲	175	▼	12.00	1
3	▲	187	▼	▲	205	▼	4.00	2
4	▲	61	▼	▲	61	▼	1.33	3
5	▲	61	▼	▲	61	▼	.44	4
6	▲	61	▼	▲	61	▼	.44	4
7	▲	61	▼	▲	61	▼	.44	4

Mesh Positioning

Disable Auto Centering	+	X-Axis	–	+	Y-Axis	–
Mesh 1	◀		▶	▲		▼
☑ Mesh 2 - Parent 1	◀	17	▶	▲	18	▼
☑ Mesh 3 - Parent 2	◀	57	▶	▲	52	▼
□ Mesh 4	◀	0	▶	▲	0	▼
□ Mesh 5	◀	0	▶	▲	0	▼
□ Mesh 6	◀	0	▶	▲	0	▼
□ Mesh 7	◀	0	▶	▲	0	▼

Map Options

Latitude: 30.050 Degrees: 30 02 58.95

Longitude: -004.267 Degrees: 004 16 01.33

Display Image: Topography ON

Current Project

Runtime Estimate : Output Size: Memory: NA

Status Log

Obtaining new image map.

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Figure 4: Positioning tab view of the Map Projection window.

a. Number of Nests: To choose three (or more) nests, click on the "3" in the **Mesh #** column. An orange nest will appear on the map for nest 3.

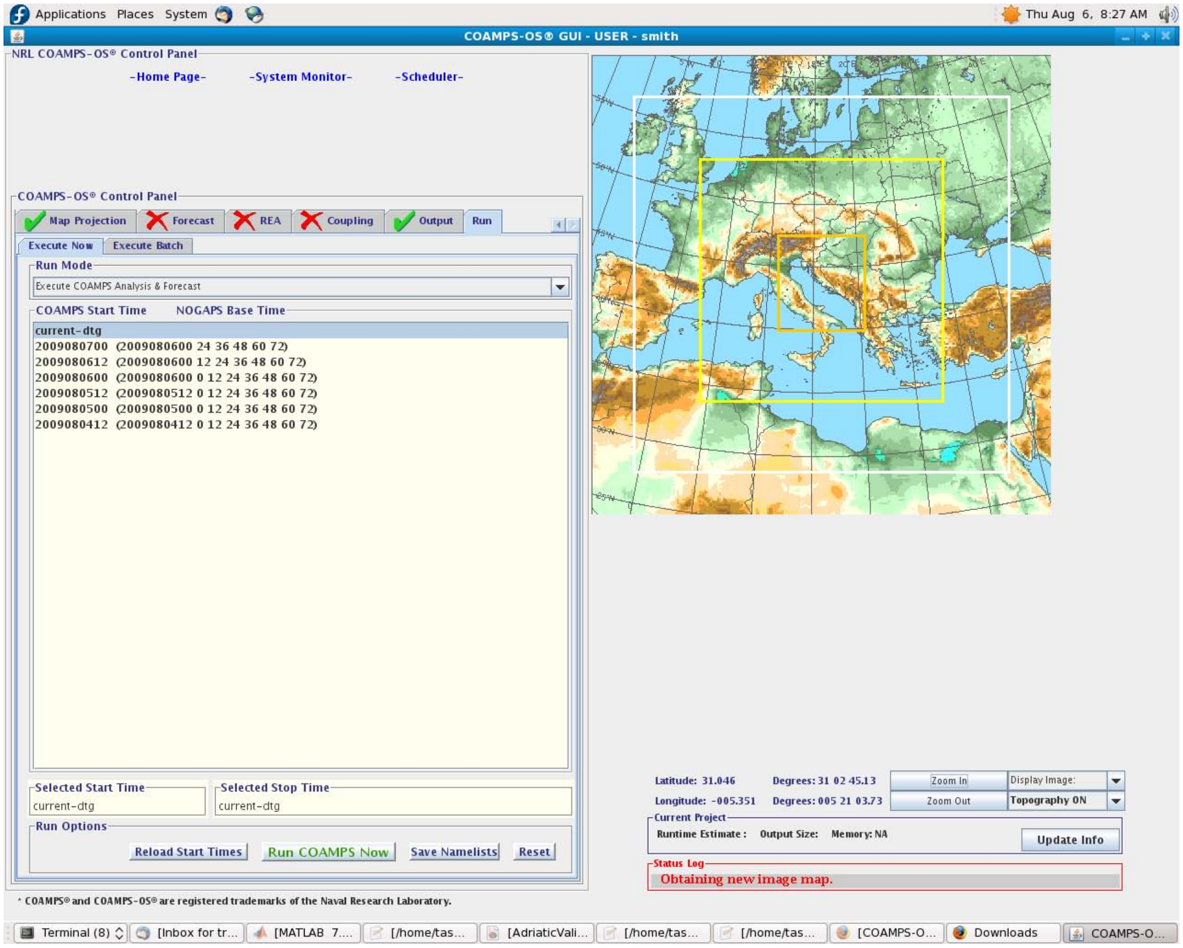
b. Nest Resolution: Adjust the resolution of the nests in the spacing column. The default for three nests is 54, 18, and 6 km. If a change in nest resolution is made, COAMPS-OS will automatically adjust the spacing of the other nests to a 3:1 ratio. For instance, if the spacing of nest 1 is changed to 27 km, the spacing for nest 2 and nest 3 will automatically change to 9 and 3 km, respectively.

c. Grid Size: Adjust the grid size by clicking the up and down arrows in the X-axis and Y-axis columns. The number of grid points of each nest is displayed.

d. Grid Position: Adjust the position of each of the grids in the **Mesh Positioning** section. There are two ways the nest positioning can be accomplished. To keep the inner nests centered with respect to the outer nests, just move Mesh 1 by clicking on the up, down, left, and right arrows in the X-axis and Y-axis columns. To move an individual nest within the primary grid, click the boxes next to the **Mesh** # and then use the arrows to move the individual nest.

2.6.3 Saving the COAMPS-OS Project

After the nest setup is complete, click on the **Run** tab in the COAMPS-OS Control Panel (See Figure 5). A prompt will appear to save the current project. Click **Cancel**. A prompt will then appear to save the project. Click **OK**. The next prompt will ask about run confirmation. Click **OK** and then enter a name for the project in the **Save File As** field then click **OK** again.



Run Mode: Execute COAMPS Analysis & Forecast

```
current-dtg
2009080700  (2009080600 24 36 48 60 72)
2009080612  (2009080600 12 24 36 48 60 72)
2009080600  (2009080600 0 12 24 36 48 60 72)
2009080512  (2009080512 0 12 24 36 48 60 72)
2009080500  (2009080500 0 12 24 36 48 60 72)
2009080412  (2009080412 0 12 24 36 48 60 72)
```

Selected Start Time: current-dtg
Selected Stop Time: current-dtg

Latitude: 31.046 Degrees: 31 02 45.13
Longitude: -005.351 Degrees: 005 21 03.73
Display Image: Topography ON

Runtime Estimate : Output Size: Memory: NA

Obtaining new image map.

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Figure 5: The Run tab on the Control Panel offers several options for setting up and executing a COAMPS-OS run.

2.6.4 Saving the COAMPS-OS Namelists

After the project is saved, click on the **Run** tab again in the COAMPS-OS Control Panel. Click **OK** at the prompt. Click on the **Save Namelists** button under the **Execute Now** tab.

The namelist ***current-dtg.nl***, containing the nest information, will be saved to the location that the user specifies.

2.6.5 Transfer Grid Information to COAMPS

Find the **[name of project].current-dtg.nl** file, saved to a user-specified location (Section 2.6.4). The grid information is under the `&gridnl` title heading at the top of the file. The ***gridnl*** information must be **exactly copied** into the ***gridnl_atmos*** namelist in the ***/projects/[region]*** directory.

3.0 RUNNING A SIMULATION

3.1 Execution of the Run Script

The functionality of the run script, **run_coamps,** in the ***jobs/[region]*** directory includes a number of arguments that may be specified for a specific case, such as fully coupled, one-way, and stand alone simulations or runs with/without data assimilation. The run script must be executed in the ***jobs/[region]*** directory, and the following command, including arguments, must be specified:

```
$RUNSCRIPTNAME [options] [beginning date-time-group],
```

where $RUNSCRIPTNAME is the name of the run script including its location relative to the ***jobs/[region]*** directory.

3.1.1 Options

The following sections offer several choices to customize the user's COAMPS run. Examples of run script commands are found in Section 3.2.

3.1.1.1 Observational Data Options (-d)

-d Command Choice #	Description
0	No action. (This is the default if all data is already in the appropriate directories).
1	Get the ADP (atmospheric) data archived on *NEWTON*. They are available for COAMPS runs at the DSRC (e.g. *BABBAGE, DAVINCI, or EINSTEIN*) only.
2	Get the OCNQC (ocean quality controlled) data on *NEWTON*. They are available for COAMPS runs at the DSRC (e.g. *BABBAGE, DAVINCI, or EINSTEIN*) only.
3	Get the ADP and OCNQC data.

3.1.1.2 Global Model Data Options (-g)

-g Command Choice #	Description
0	No action (default).

1	Get the NOGAPS fields archived on *NEWTON*. They are available for COAMPS runs at the DSRC (e.g. *BABBAGE, DAVINCI, or EINSTEIN*) only.
2	Get the global NCOM fields archived on *NEWTON*. They are available for a COAMPS run at the DSRC (e.g. *BABBAGE, DAVINCI, or EINSTEIN*) only.
3	Cut the global NCOM fields to a specified area.
4	(1) and (2).
5	(1) and (3).
6	(2) and (3).
7	(1), (2) and (3).

3.1.1.3 Atmospheric Analysis Options (-a)

-a Command Choice #	**Description**
0	No action (default).
1	Run the atmospheric analysis (*coama*) with NAVDAS (currently disabled).
2	Run the atmospheric analysis *(coama)* with MVOI (must specify for coupled data assimilation run).
3	Run ocean analysis (NCODA) on atmospheric grids.
4	(1) and (3). This is currently disabled.
5	(2) and (3).

3.1.1.4 Ocean Analysis Options (-o)

-o Command Choice #	**Description**
0	No action (default).
1	Run NCOM ocean configuration program (***ocean_config)***.
2	Run ocean analysis (NCODA) on ocean grids.
3	(1) and (2). This is currently disabled.

3.1.1.5 Wave Analysis Options (-w)

-w Command Choice #	Description
0	No action (default).
1	Run wave configuration (***wave_config***). This is currently disabled.

3.1.1.6 Forecast Options (-f)

-f Command Choice #	Description
0	No action (default).
1	Run coupled forecast.
2	Run stand-alone atmospheric forecast.
3	Run stand-alone ocean forecast.
4	Run stand-alone wave forecast.

3.1.1.7 NCODA Graphics Options (-p) (Currently Disabled)

-p Command Choice #	Description
0	No action (default).
1	Run NCODA **plotxy**.
2	Run **ncoda_map**.
3	(1) and (2).

3.1.1.8 Get RELO NCOM IC/BC .tar File (-y)

-y Command Choice #	Description
Place IC/BC input files (or replace existing ones) with a tar file created from the RELO NCOM setup found in the ocean data directory. The –y command is where the IC/BC tar file is located.	

3.1.1.9 Ending date-time-group Option (-e)

-e Command	Description

Choice #	
-e	yyyymmddhh.

3.2 Run Command Examples

3.2.1 Two-way, Fully Coupled Run with Data Assimilation

For a fully coupled two-way run with data assimilation, the following run command should be executed in the ***jobs/[region]*** directory. Option `–a5` must always be specified in order to run the two-way coupling with data assimilation. This command is for running COAMPS on the local workstation or grid engine and only if all the input data has been downloaded from *NEWTON*.

```
../../scripts/run_coamps -g3 -a5 -o1 -f1 -y (directory where RELO NCOM tar file is located) -e yyyymmddhh (ending DTG) yyyymmddhh (start DTG)
```

3.2.2 Two-way, Fully Coupled Run with Data Assimilation on DSRC Platforms

Use the following run command for execution on *BABBAGE, DAVINCI, or EINSTEIN* platforms.

```
../../scripts/run_coamps -d3 -g7 -a5 -o1 -f1 -y
[directory where RELO NCOM tar file is located]
-e yyyymmddhh (ending DTG) yyyymmddhh (start DTG)
```

3.3 Log Files

The log and command files are located in the ***outDataDir/[region]/run/[DTG]*** directory for the user's specific DTG. Each DTG directory contains several log files. Table 4 describes the important log files.

Table 4: Log file descriptions.

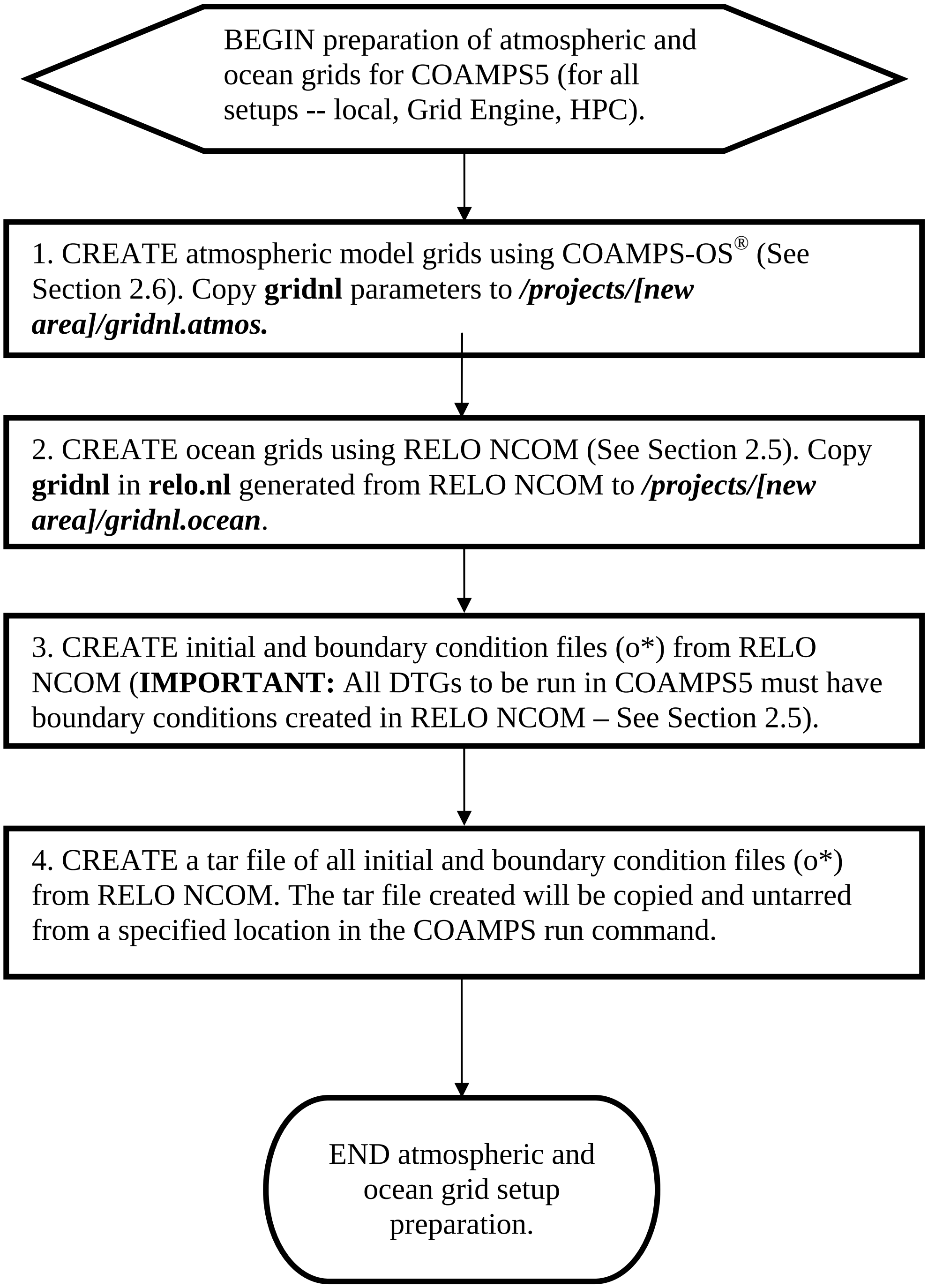
Log File	Description
log.aanalysis	Atmospheric analysis log.
log.config	Ocean analysis log.
log.oanalysis.atmos	NCODA log.
log.cforecast	Coupled model log.

3.4 Atmosphere and Ocean Output Files

The output for both the atmosphere and ocean is standard COAMPS binary flat file output, as specified in the COAMPS User's Manual (Chen et al., 2003). If running COAMPS locally or on the Grid Engine, output for both the atmosphere and ocean is located in the output directories specified in the **setup_nrlssc** script. Output for COAMPS running on the DSRC (as specified in **setup_navy_dsrc**) is located in the ***/scr/[user]/COAMPS/data/[region]*** directory.

3.5 COAMPS Flow of Execution

3.5.1 Atmospheric and Ocean Grid Preparation Flowchart



BEGIN preparation of atmospheric and ocean grids for COAMPS5 (for all setups -- local, Grid Engine, HPC).

1. CREATE atmospheric model grids using COAMPS-OS® (See Section 2.6). Copy **gridnl** parameters to ***/projects/[new area]/gridnl.atmos.***

2. CREATE ocean grids using RELO NCOM (See Section 2.5). Copy **gridnl** in **relo.nl** generated from RELO NCOM to ***/projects/[new area]/gridnl.ocean***.

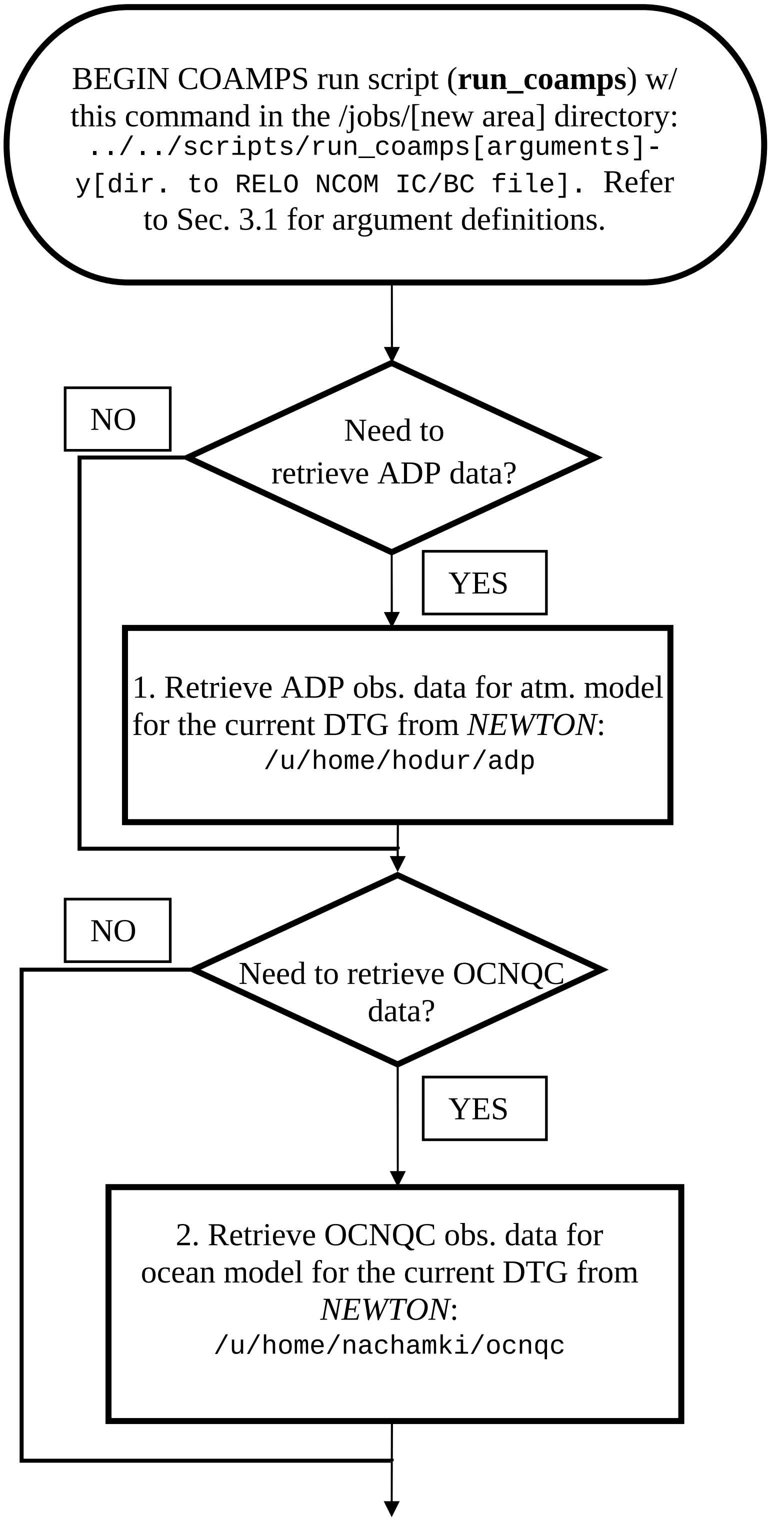
3. CREATE initial and boundary condition files (o*) from RELO NCOM (**IMPORTANT:** All DTGs to be run in COAMPS5 must have boundary conditions created in RELO NCOM – See Section 2.5).

4. CREATE a tar file of all initial and boundary condition files (o*) from RELO NCOM. The tar file created will be copied and untarred from a specified location in the COAMPS run command.

END atmospheric and ocean grid setup preparation.

Figure 6: COAMPS5 Flow of Execution.

3.5.2 COAMPS Operational Flowchart (Based On HPC BABBAGE Usage)



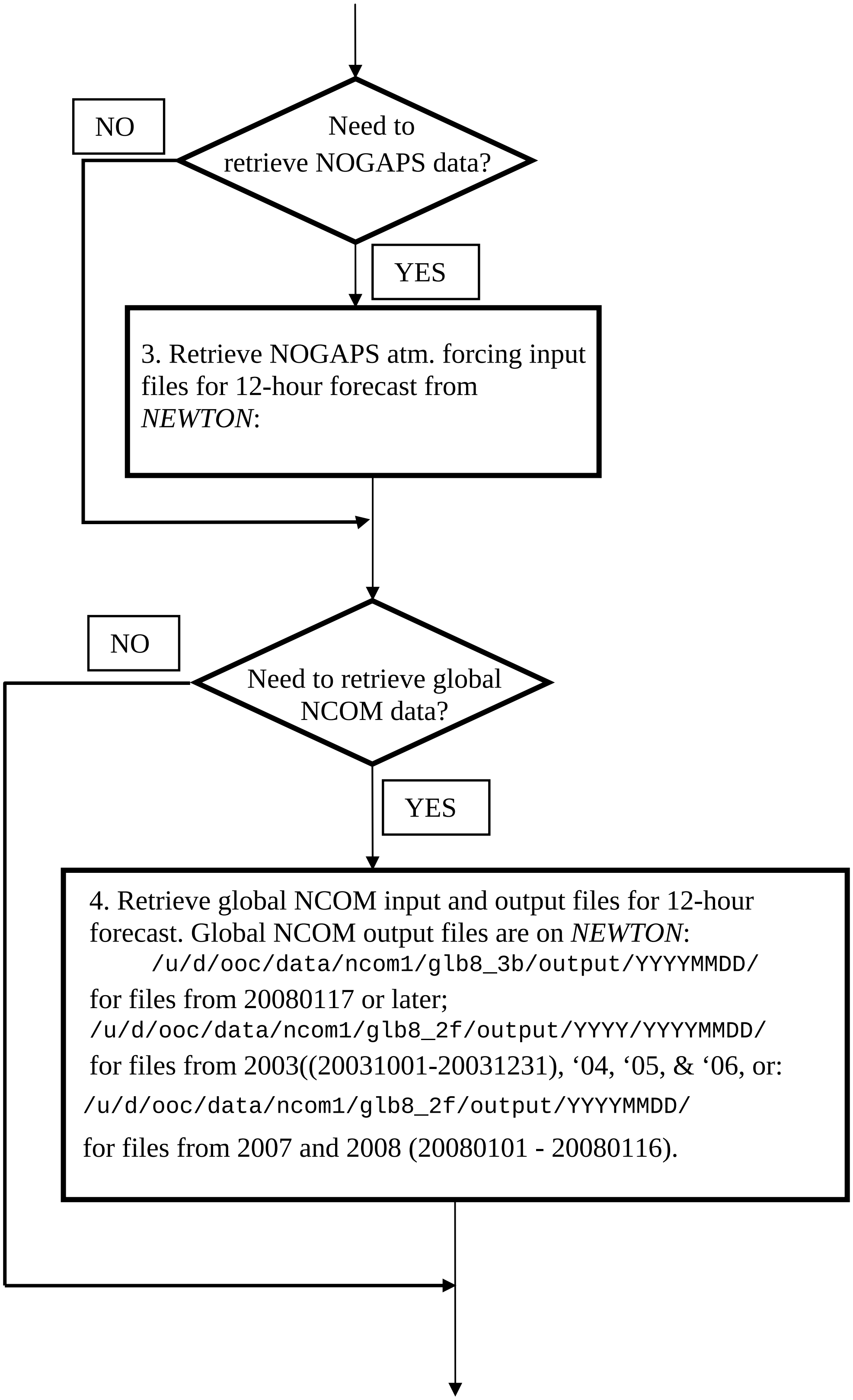
BEGIN COAMPS run script (**run_coamps**) w/ this command in the /jobs/[new area] directory: `../../scripts/run_coamps[arguments]-y[dir. to RELO NCOM IC/BC file].` Refer to Sec. 3.1 for argument definitions.

Need to retrieve ADP data?

1. Retrieve ADP obs. data for atm. model for the current DTG from *NEWTON*: `/u/home/hodur/adp`

Need to retrieve OCNQC data?

2. Retrieve OCNQC obs. data for ocean model for the current DTG from *NEWTON*: `/u/home/nachamki/ocnqc`


NO
Need to retrieve NOGAPS data?
YES
NO
Need to retrieve global NCOM data?
YES

3. Retrieve NOGAPS atm. forcing input files for 12-hour forecast from *NEWTON*:

4. Retrieve global NCOM input and output files for 12-hour forecast. Global NCOM output files are on *NEWTON*:

```
/u/d/ooc/data/ncom1/glb8_3b/output/YYYYMMDD/
```

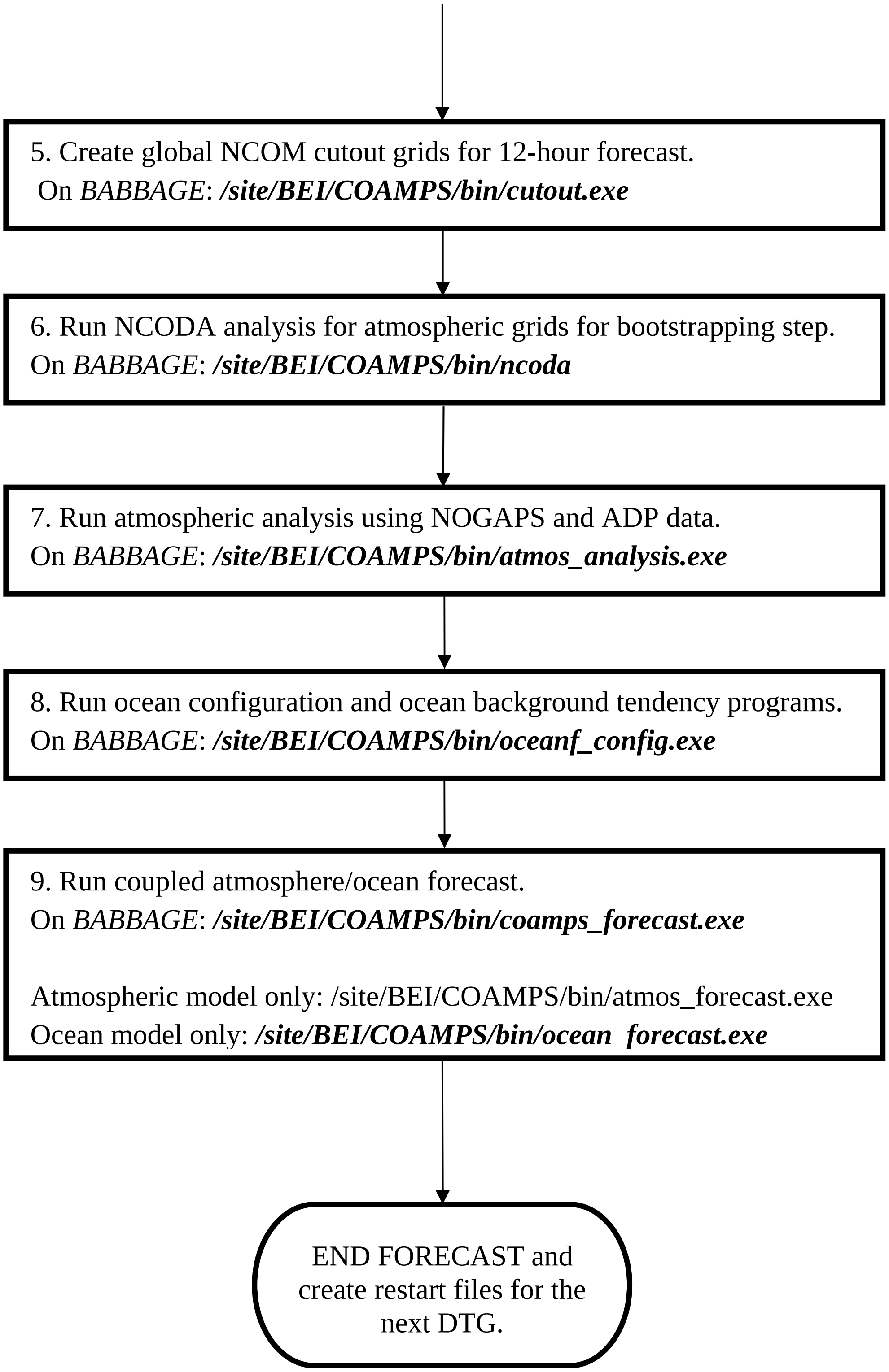
for files from 20080117 or later;

```
/u/d/ooc/data/ncom1/glb8_2f/output/YYYY/YYYYMMDD/
```

for files from 2003((20031001-20031231), '04, '05, & '06, or:

```
/u/d/ooc/data/ncom1/glb8_2f/output/YYYYMMDD/
```

for files from 2007 and 2008 (20080101 - 20080116).



5. Create global NCOM cutout grids for 12-hour forecast.
On *BABBAGE*: ***/site/BEI/COAMPS/bin/cutout.exe***

6. Run NCODA analysis for atmospheric grids for bootstrapping step.
On *BABBAGE*: ***/site/BEI/COAMPS/bin/ncoda***

7. Run atmospheric analysis using NOGAPS and ADP data.
On *BABBAGE*: ***/site/BEI/COAMPS/bin/atmos_analysis.exe***

8. Run ocean configuration and ocean background tendency programs.
On *BABBAGE*: ***/site/BEI/COAMPS/bin/oceanf_config.exe***

9. Run coupled atmosphere/ocean forecast.
On *BABBAGE*: ***/site/BEI/COAMPS/bin/coamps_forecast.exe***

Atmospheric model only: /site/BEI/COAMPS/bin/atmos_forecast.exe
Ocean model only: ***/site/BEI/COAMPS/bin/ocean forecast.exe***

END FORECAST and
create restart files for the
next DTG.

Figure 7: COAMPS Operational Flowchart.

4.0 FUNCTIONAL DESCRIPTION

Please refer to Chen et al., (2003), for a comprehensive description of the basic equations theory, and code of the COAMPS model. For NCOM, see Barron et al., (2006) and Martin et al., (2008a).

5.0 TECHNICAL REFERENCES

5.1 COAMPS Software Documentation

Barron, C.N., A.B. Kara, P.J. Martin, R.C. Rhodes, and L.F. Smedstad. (2006). Formulation, implementation and examination of vertical coordinate choices in the Global Navy Coastal Ocean Model (NCOM). *Ocean Modelling*, **11:** 347-375.

Chen, S., J. Cummings, J. Doyle, R.H. Hodur, T. Holt, C. Liou, M. Liu, A. Mirin, J. Ridout, J.M. Schmidt, G. Sugiyama, and W.T. Thompson, (2003). "COAMPS Version 3 Model Description--General Theory and Equations". NRL/PU/7500--03-448, 145 pp.

Martin, P.J., C.N. Barron, L.F. Smedstad, A.J. Wallcraft, R.C. Rhodes, T.J. Campbell, C. Rowley and S.N. Carroll, (2008a). Software Design Description for the Navy Coastal Ocean Model Version 4.0." NRL/MR/7320--08-9149, Ocean Modeling Division, Naval Research Laboratory, Stennis Space Center, MS.

Martin, P.J., C.N. Barron, L.F. Smedstad, T.J. Campbell, A.J. Wallcraft, R.C. Rhodes, C. Rowley, T.L. Townsend, and S.N. Carroll, (2008b). "User's Manual for the Navy Coastal Ocean Model (NCOM) Version 4.0." NRL/MR/7320--08-9151, Ocean Modeling Division, Naval Research Laboratory, Stennis Space Center, MS.

5.2 General Technical References

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Blumberg, A. F. and Mellor, G. L., (1987). "A description of a three-dimensional coastal ocean circulation model." In: Three-Dimensional Coastal Ocean Models. N. Heaps, ed., American Union, New York, N.Y., p. 208.

Collins-Sussman, B., B.W. Fitzpatrick, and C.M. Pilato. "Version Control with Subversion." [Online]. Copyright © 2002, 2003, 2004, 2005, 2006, 2007 O'Reilly Media Inc, Sebastopol, CA. <http://subversion.tigris.org/>.

Geiszler, D., R. Wade, and J. Cook, (2003). The Naval Research Laboratory's Satellite Server (NRLSAT): An automated cloud verification system for COAMPS-OS® Battlespace Atmospheric and Cloud Impacts on Military Operations [BACIMO] Conference, Monterey, CA.

Hodur, R.M., (1997). The Naval Research Laboratory's Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS). *Mon. Wea. Rev.* **125**: 1414-1430.

Louis, J. F., M. Tiedtke and J. F. Geleyn, (1981). A short history of the operational PBL-parameterization at ECMWF, Workshop on Planetary Boundary Layer Parameterization, 25-27 Nov. 1981, 59-79.

Martin, P. J., G. Peggion, and K. J. Yip, (1998). "A comparison of several coastal ocean models." NRL Report NRL/FR/7322--97-9692. Naval Research Laboratory, Stennis Space Center, MS., 96.

Pullen, J., J. Doyle, T. Haack, C. Dorman, R. Signell, C. Lee, (2007). Bora Event Variability and the Role of Air-Sea Feedback, *J. Geophys. Res*., **112** (C3): C03S18.

6.0 NOTES

6.1 Acronyms and Abbreviations

Acronym	Description
ADP	Atmospheric Data
BC	Boundary Conditions
COAMPS	Coupled Ocean Atmospheric Mesoscale Prediction System
COAMPS-OS	Coupled Ocean Atmospheric Mesoscale Prediction System-On Scene
DoD	Department of Defense
DSRC	DoD Supercomputing Resource Centers
DTG	Date-Time-Group
ESMF	Earth System Modeling Framework
GB	Gigabyte
GNCOM	Global NCOM
GUI	Graphical User Interface
GVC	General Vertical Coordinate
HPC	High Performance Computing
HPCMP	High Performance Computing Modernization Program
I/O	Input/Output
IC	Initial (Boundary) Conditions
IP	Internet Protocol
LBC	Lateral Boundary Conditions
MVOI	Multi-variate Optimal Interpolation
MYL2/2.5	Mellor Yamada Level 2/2.5
NASA	National Aeronautical and Space Administration
NAVDAS	NRL Atmospheric Variational Data Assimilation System
NAVOCEANO	Naval Oceanographic Office
NCAR	National Center for Atmospheric Research
NCODA	Navy Coupled Ocean Data Assimilation system
NCOM	Navy Coastal Ocean Model
NFS	Network File System
NOGAPS	Navy Operational Global Atmospheric Prediction System
NRL-MRY	Naval Research Laboratory, Monterey
NRL-SSC	Naval Research Laboratory, Stennis Space Center
OCNQC	Quality Controlled Ocean Data
POM	Princeton Ocean Model
RELO NCOM	Relocatable Navy Coastal Ocean Model
SST	Sea Surface Temperature

Acronym	Description
SZM	Sigma/Z- level Model
TEDS	Tactical Environmental Database Services

Appendix A: COAMPS Platform Setup Script (setup_nrlssc)

```
#------------------------------------------------------------------------------#
#
# Script: setup_nrlssc
#         COAMPS site setup for NRLSSC platforms with SGE (Sun GridEngine)
#               xeon (Intel Xeon nodes)
#         To select a specific queue set the queue variable in the batch
#         job settings section.
#
# Purpose:
#   This script, sourced by run_coamps, adds site/platform specific settings
#   to the batch command file and sets platform specific variables that are
#   used in run_coamps.
#
# Require input parameters:
#   NONE
#
# Global variables required:
#   USER               : user name (environment)
#   platform           : name of platform (host machine)
#   coampsV            : COAMPS version (4 or 5)
#   jobDir             : path to job directory (where run_coamps is invoked)
#   jobName            : name of batch job
#   cmdFile            : batch command file (with path)
#   cmdLog             : batch command log file (with path)
#   area               : name of simulation area/experiment
#   ddtg               : date-time-group of run
#   total_nprocs       : total number of processors
#   atmos_nprocs       : number of processors for atmos
#   ocean_nprocs       : number of processors for ocean
#    wave_nprocs       : number of processors for wave
#   interactive_option : flag indicating job is interactive
#
# Global variables created:
#   runDir  : area ddtg run directory
#   prjDir  : projects area/experiment input file directory
#   binDir  : full NFS path to the COAMPS bin directory
#   batch   : batch submission command
#   + variables for path & archive commands
#   + variables for execution commands
#
#------------------------------------------------------------------------------#

#------------------------------------------------------------------------------#
# check for required global variables
#------------------------------------------------------------------------------#
if [[ -z $HOME || -z $platform || -z $coampsV || \
      -z $jobDir || -z $jobName || -z $cmdFile || -z $cmdLog || \
      -z $area || -z $ddtg || \
      -z $total_nprocs || -z $atmos_nprocs || -z $ocean_nprocs || \
      -z $wave_nprocs ||  -z $interactive_option ]]
then
  error_msg "$0: required global variables not defined"; exit 1
fi
if [[ ! -e $cmdFile ]]
then
  error_msg "$0: batch command file does not exist: $cmdFile"; exit 1
fi
#------------------------------------------------------------------------------#

#------------------------------------------------------------------------------#
# process input parameters
#------------------------------------------------------------------------------#
if [[ $# != 0 ]]
then
  error_msg "$0: incorrect number of input parameters"; exit 1
fi
#------------------------------------------------------------------------------#

#------------------------------------------------------------------------------#
# check for supported platform
#------------------------------------------------------------------------------#
case $platform in
  xeon) ;;
  *) error_msg "$0: unsupported platform: $platform"; exit 1 ;;
esac
#------------------------------------------------------------------------------#

#------------------------------------------------------------------------------#
# local variables
#------------------------------------------------------------------------------#
# HPCMP kerberos user name
typeset kuser="$USER"

# path to local COAMPS output data directory
typeset outDataDir="/u/COAMPS/data/$USER"

# path to local COAMPS save data directory
typeset savDataDir="/u/COAMPS/save/$USER"
#------------------------------------------------------------------------------#

#------------------------------------------------------------------------------#
# global variables
#------------------------------------------------------------------------------#
# runDir: area ddtg run directory
# default value is "$outDataDir/$area/run/$ddtg"
runDir="$outDataDir/$area/run/$ddtg"

# prjDir: projects area input file directory
# default value is "$jobDir/../../projects/$area"
prjDir="$jobDir/../../projects/$area"

# binDir: full NFS path to the COAMPS bin directory
case $platform in
  xeon) binDir="/u/COAMPS/src/coamps${coampsV}/bin" ;;
esac

# batch submission command
batch=qsub
#------------------------------------------------------------------------------#

#==============================================================================#
# add batch directives to batch command file
#==============================================================================#

#------------------------------------------------------------------------------#
# queue selection
#   xeon : sea.q, collective.q
#------------------------------------------------------------------------------#
typeset queue
case $platform in
  xeon) queue="sea.q,collective.q" ;;
esac
#------------------------------------------------------------------------------#

cat >> $cmdFile << End_Batch_Directives
#------------------------------------------------------------------------------#
# batch directives
#------------------------------------------------------------------------------#
#$ -S /bin/ksh
#$ -V
#$ -N ${jobName}
#$ -o ${cmdLog}
#$ -j y
#$ -m as
#$ -q ${queue}
#$ -pe orte ${total_nprocs}
#$ -l arch=lx24-amd64
#------------------------------------------------------------------------------#
End_Batch_Directives
printf "\n\n" 1>> $cmdFile
#==============================================================================#

#==============================================================================#
# add paths and archive commands to batch command file
#==============================================================================#

cat >> $cmdFile << End_Paths_And_Archive_Commands
#------------------------------------------------------------------------------#
# paths and archive commands
```

```
#------------------------------------------------------------------------------#

# path to COAMPS database
databaseDir=/u/COAMPS/input/database

# path to TC warning database
tcDir=/u/COAMPS/input/TCWarnings

# path to local f and adp data
fandaDir=/u/COAMPS/input/fanda

# path to local ocnqc data
ocnqcDir=/u/COAMPS/input/ocnqc

# path to local gncom data
gncomDir=/u/COAMPS/input/gncom

# paths to model output data
dataDir=$outDataDir/$area
atmosDir=$outDataDir/$area/atmos
oceanDir=$outDataDir/$area/ocean
waveDir=$outDataDir/$area/wave
obkgdDir=$outDataDir/$area/obkgd
wbkgdDir=$outDataDir/$area/wbkgd
cutoutDir=$outDataDir/$area/cutout

# run archive copy command and archive path
saveDir=$savDataDir/$area
archiveCopyCmd=cp
archiveDir=$savDataDir/$area

# gncom archive copy command and archive path
# (don't include dtg dependence in path, this is handled by retrieve function)
gncomCopyCmd=krcp
gncomArchiveInpDir=$kuser@newton:/u/d/ooc/data/ncom1/glb8_2a
gncomArchiveOutDir=$kuser@newton:/u/d/ooc/data/ncom1/glb8_2f/output

# nogaps archive copy command and archive path
nogapsArchiveCopyCmd=krcp
nogapsArchiveDir=$kuser@newton:/u/home/hodur/masfnmc

# adp archive copy command and archive path
adpArchiveCopyCmd=krcp
adpArchiveDir=$kuser@newton:/u/home/hodur/adp

# ocnqc archive copy command and archive path
ocnqcArchiveCopyCmd=krcp
ocnqcArchiveDir=$kuser@newton:/u/home/nachamki/ocnqc

# NCODA plot stuff
plotxyDir=
ncodamapDir=

# NAVDAS stuff
coampsDir=
navdasDir=
navdas_data=
tfileDir=
scrDir=
scrDir2=
expName=

#------------------------------------------------------------------------------#
End_Paths_And_Archive_Commands
printf "\n\n" 1>> $cmdFile
#==============================================================================#

#==============================================================================#
# add execution commands to batch command file
#==============================================================================#

typeset mpicmd
case $platform in
  *)  mpicmd="mpirun -np" ;;
esac

cat >> $cmdFile << End_Execution_Commands
#------------------------------------------------------------------------------#
# execution commands
#------------------------------------------------------------------------------#

# mpi dependent commands
atmos_forecast="$mpicmd $atmos_nprocs $binDir/atmos_forecast.exe"
ocean_forecast="$mpicmd $ocean_nprocs $binDir/ocean_forecast.exe"
wave_forecast="$mpicmd $wave_nprocs $binDir/wave_forecast.exe"
coamps_forecast="$mpicmd $total_nprocs $binDir/coamps_forecast.exe"
atmos_analysis="$mpicmd 1 $binDir/atmos_analysis.exe"
ocean_analysis="$mpicmd 1 $binDir/ncoda"

# non-mpi dependent commands
newdtg="$binDir/newdtg.exe"
cutout="$binDir/cutout.exe"
oceanf_config="$binDir/oceanf_config.exe"
wavef_config="$binDir/wavef_config.exe"
swan_hcat="$binDir/swan_hcat.exe"
ocean_analysis_prep="$binDir/ncoda_prep"
ocean_analysis_post="$binDir/ncoda_post"
ocean_analysis_convrt="$binDir/ncoda_convrt"

# uncompress command
uncompressCmd=gunzip
```

```
#------------------------------------------------------------------------------#
End_Execution_Commands
printf "\n\n" 1>> $cmdFile
#==============================================================================#

#==============================================================================#
# add environment settings to batch command file
#==============================================================================#

case $platform in

*)
cat >> $cmdFile << End_Environment_Settings
#------------------------------------------------------------------------------#
# environment settings
#------------------------------------------------------------------------------#

#------------------------------------------------------------------------------#
End_Environment_Settings
;;

esac
printf "\n\n" 1>> $cmdFile
#==============================================================================#

#==============================================================================#
# SGE (batch) job must use NFS paths
#==============================================================================#
if [[ $interactive_option != 1 ]]
then
case $(print $jobDir | cut -f2 -d/) in
  u|net|home) ;;
  *) echo "$myname: SGE job must be submitted from NFS directory" 1>&2 ;
     exit 1 ;;
esac
case $(print $outDataDir | cut -f2 -d/) in
  u|net|home) ;;
  *) echo "$myname: SGE job must use NFS path for output data directory" 1>&2 ;
     exit 1 ;;
esac
case $(print $savDataDir | cut -f2 -d/) in
  u|net|home) ;;
  *) echo "$myname: SGE job must use NFS path for save data directory" 1>&2 ;
     exit 1 ;;
esac
fi
#==============================================================================#

#------------------------------------------------------------------------------#
# end of script
#------------------------------------------------------------------------------#
```

Appendix B: COAMPS Run Parameter Setup Script (setup_area)

```
#------------------------------------------------------------------------------#
#
# Script: setup_area
#
# Purpose:
#   This script, sourced by run_coamps5, sets the simulation area specific
#   variables that are used in run_coamps5.
#
# Require input parameters:
#   NONE
#
# Global variables required:
#   jobDir  : path to job directory (where run_coamps is invoked)
#
# Global variables created:
#   area             : name of simulation area/experiment
#   jobName          : name of batch job
#   cmdFile          : batch command file (with path)
#   cmdLog           : batch command log file (with path)
#   coampsV          : COAMPS version (4 or 5)
#   site             : name of site (corresponds to setup_${site}).
#   platform         : name of platform (host machine) -- used in setup_${site}
#   update_cycle     : number of hours for hindcast/forecast update cycle
#   atmos_nproc(x,y) : number of tiles in x and y-direction for atmos
#   ocean_nproc(x,y) : number of tiles in x and y-direction for ocean
#    wave_nproc(x,y) : number of tiles in x and y-direction for  wave
#   gatm_fcst        : global-atmos analysis forecast/hindcast lbc flag
#   gatm_step        : frequency in hr of global-atmos fields
#   gatm_length      : end forecast hr to get global-atmos fields
#   gocn_fcst        : global-ocean analysis forecast/hindcast lbc flag
#   gocn_step        : frequency in hr of global-ocean fields
#   gocn_length      : end forecast hr to get global-ocean fields
#   ocards & xcards  : names ocards and xcards files (in project directory)
#
# A section is available near the end of this function for creating user
# specific global variables.
#
#------------------------------------------------------------------------------#

#------------------------------------------------------------------------------#
# check for required global variables
#------------------------------------------------------------------------------#
if [[ -z $jobDir ]]
then
  error_msg "$0: required global variables not defined"; exit 1
fi
#------------------------------------------------------------------------------#

#------------------------------------------------------------------------------#
```

```
# process input parameters
#------------------------------------------------------------------------------#
if [[ $# != 0 ]]
then
  error_msg "$0: incorrect number of input parameters"; exit 1
fi
#------------------------------------------------------------------------------#

#------------------------------------------------------------------------------#
# setup
#------------------------------------------------------------------------------#
#
# area: name of simulation area/experiment
# default value is "$(basename $jobDir)"
#
area="$(basename $jobDir)"

#
# jobName: name of batch job
# default value is "$area.$ddtg"
#
jobName="$area.$ddtg"

#
# cmdFile: batch command script
# default value is "$jobDir/cmd.$ddtg"
#
cmdFile="$jobDir/cmd.$ddtg"

#
# cmdLog: batch command log file (with path)
# default value is "$jobDir/log.$ddtg"
#
cmdLog="$jobDir/log.$ddtg"

#
# coampsV: COAMPS version (4 or 5)
#
coampsV=5

#
# site    : name of site (corresponds to setup_${site} function)
# platform: name of platform (host machine)
#           *** must be a supported platform in setup_${site} ***
#
site=nrlssc
platform=xeon

#
# update_cycle: number of hours for hindcast/forecast update cycle
#
```

```
update_cycle=12

#
# concurrent_cpl_mode=t - coupled forecast with execute in concurrent mode
#                         ** atmos, ocean & wave on different sets of processors
#                         ** total # procs = # atmos procs + # ocean procs + # wave
procs
#                    =f - coupled forecast with execute in sequential mode
#                         ** atmos, ocean & wave on same set of processors
#                         ** total # procs = # atmos procs = # ocean procs = # wave
procs
#
concurrent_cpl_mode=f

#
# atmos_nproc(x,y): number of tiles in x and y-direction for atmos
# ocean_nproc(x,y): number of tiles in x and y-direction for ocean
#  wave_nproc(x,y): number of tiles in x and y-direction for  wave
# ** set these according to the selected coupling mode
#
atmos_nprocx=4  ; atmos_nprocy=4  ;
ocean_nprocx=4  ; ocean_nprocy=4  ;
 wave_nprocx=4  ;  wave_nprocy=4  ;

#
# gatm_fcst=t - use global-atmos analysis as lbc
#          =f - use global-atmos forecast as lbc
# gatm_step: frequency in hr of global-atmos fields
# ** this depends on what is available for the selected dtg
# gatm_length: end forecast hr to get global-atmos fields
# ** this should be >= update_cycle
#
gatm_fcst=f
gatm_step=12
gatm_length=12

#
# gocn_fcst=t - use global-ocean forecast as lbc
#          =f - use global-ocean hindcast as lbc
# gocn_step: frequency in hr of global-ocean fields
# ** this depends on what is available for the selected dtg
# gocn_length: end forecast hr to get global-ocean fields
# ** this should be >= update_cycle
#
gocn_fcst=f
gocn_step=6
gocn_length=12


#
# ocards & xcards: names ocards and xcards files (in project directory)
```

```
#
ocards=OCARDS.default
xcards=XCARDS.default

#------------------------------------------------------------------------------#

#------------------------------------------------------------------------------#
# User specific global variables.
# *** be sure not to use typeset ***
#------------------------------------------------------------------------------#
#example_global_var=xxyyzz

#------------------------------------------------------------------------------#

#------------------------------------------------------------------------------#
# end of script
#------------------------------------------------------------------------------#
```

Appendix C: COAMPS Setup Script for Running on the DSRC (setup_navy_dsrc)

```
#---------------------------------------------------------------------#
#
# Script: setup_navy_dsrc
#         COAMPS site setup for the Navy DSRC platforms:
#               babbage (IBM P5+ with PBS)
#               davinci (IBM P6 with PBS)
#               einstein (Cray XT5 with PBS)
#
# Purpose:
#   This script, sourced by run_coamps, adds site/platform specific    settings
# to the batch command file and sets platform specific variables that are
# used in run_coamps.
#
# Require input parameters:
#   NONE
#
# Global variables required:
#   HOME               : path to user home directory (environment)
#   WORKDIR            : path to user scratch directory (environment)
#   coampsV            : COAMPS version (4 or 5)
#   platform           : name of platform (host machine)
#   jobDir             : path to job directory (where run_coamps is invoked)
#   cmdFile            : batch command file (with path)
#   cmdLog             : batch command log file (with path)
#   jobName            : name of batch job
#   area               : name of simulation area/experiment
#   ddtg               : date-time-group of run
#   total_nprocs       : total number of processors
#   atmos_nprocs       : number of processors for atmos
#   ocean_nprocs       : number of processors for ocean
#   interactive_option : flag indicating job is interactive
#
# Global variables created:
#   batch   : batch submission command
#   binDir  : full NFS path to the COAMPS bin directory
#   + variables for path & archive commands
#   + variables for execution commands
#
#-----------------------------------------------------------------------#

#-----------------------------------------------------------------------#
# check for required global variables
#-----------------------------------------------------------------------#
if [[ -z $HOME || -z $WORKDIR || -z $platform || \
      -z $jobDir || -z $cmdFile || -z $cmdLog || -z $area || -z $ddtg || \
      -z $total_nprocs || -z $atmos_nprocs || -z $ocean_nprocs || \
      -z $interactive_option ]]
then
```

```
  error_msg "$0: required global variables not defined"; exit 1
fi
if [[ ! -e $cmdFile ]]
then
  error_msg "$0: batch command file does not exist: $cmdFile"; exit 1
fi
#----------------------------------------------------------------------#

#----------------------------------------------------------------------#
# process input parameters
#----------------------------------------------------------------------#
if [[ $# != 0 ]]
then
  error_msg "$0: incorrect number of input parameters"; exit 1
fi
#----------------------------------------------------------------------#

#----------------------------------------------------------------------#
# check for supported platform
#----------------------------------------------------------------------#
case $platform in
  babbage|davinci|einstein) ;;
  *) error_msg "$0: unsupported platform: $platform"; exit 1 ;;
esac
#----------------------------------------------------------------------#

#---------------------------------------------------------------------#
# local variables
#----------------------------------------------------------------------#
# name of project account
typeset projAcct="NRLSS060"

# walltime (HH:MM:SS)
typeset wallTime="07:00:00"

# path to local COAMPS input data directory (location of fanda & ocnqc)
typeset inpDataDir="$WORKDIR/COAMPS/data"

# path to local COAMPS output data directory
typeset outDataDir="$WORKDIR/COAMPS/data"

# path to local COAMPS save data directory
typeset savDataDir="$WORKDIR/COAMPS/save"
#----------------------------------------------------------------------#

#----------------------------------------------------------------------#
# global variables
#----------------------------------------------------------------------#
# binDir: full NFS path to the COAMPS bin directory
binDir="$BEI_HOME/COAMPS/coamps${coampsV}/bin"
```

```
# batch submission command
batch=qsub
#------------------------------------------------------------------------#

#========================================================================#
# add batch directives to batch command file
#========================================================================#

#------------------------------------------------------------------------#
# number of cpus per node (<= number of physical cpus per node)
#   babbage:  num_physical_cpus_per_node=16
#   davinci:  num_physical_cpus_per_node=32
#   einstein: num_physical_cpus_per_node=8
#------------------------------------------------------------------------#
typeset ncpus_per_node
case $platform in
  babbage)  ncpus_per_node=16 ;;
  davinci)  ncpus_per_node=32 ;;
  einstein) ncpus_per_node=8  ;;
esac
#------------------------------------------------------------------------#

#------------------------------------------------------------------------#
# number of nodes
#------------------------------------------------------------------------#
typeset nnodes=$(( total_nprocs / ncpus_per_node ))
if (( total_nprocs - nnodes*ncpus_per_node > 0 ))
then
  nnodes=$(( nnodes + 1 ))
fi
#------------------------------------------------------------------------#

case $platform in

babbage|davinci)
cat >> $cmdFile << End_Batch_Directives
#------------------------------------------------------------------------#
# batch directives
#------------------------------------------------------------------------#
#PBS -V
#PBS -A ${projAcct}
#PBS -N ${jobName}
#PBS -o ${cmdLog}
#PBS -j oe
#PBS -l walltime=${wallTime}
#PBS -l select=${nnodes}:ncpus=${ncpus_per_node}:mpiprocs=${ncpus_per_node}
#PBS -l place=scatter:excl
#PBS -q standard
#------------------------------------------------------------------------#
End_Batch_Directives
;;
```

```
einstein)
cat >> $cmdFile << End_Batch_Directives
#-----------------------------------------------------------------------#
# batch directives
#-----------------------------------------------------------------------#
#PBS -V
#PBS -A ${projAcct}
#PBS -N ${jobName}
#PBS -o ${cmdLog}
#PBS -j oe
#PBS -l walltime=${wallTime}
#PBS -l mppwidth=${total_nprocs}
#PBS -l mppnppn=${ncpus_per_node}
#PBS -q standard
#-----------------------------------------------------------------------#
End_Batch_Directives
;;

esac
printf "\n\n" 1>> $cmdFile
#=======================================================================#

#=======================================================================#
# add paths and archive commands to batch command file
#=======================================================================#

cat >> $cmdFile << End_Paths_And_Archive_Commands
#-----------------------------------------------------------------------#
# paths and archive commands
#-----------------------------------------------------------------------#

# path to COAMPS database
databaseDir=$BEI_HOME/COAMPS/database

# path to TC warning database
tcDir=$BEI_HOME/COAMPS/TCWarnings

# path to local f and adp data
fandaDir=$inpDataDir/fanda

# path to local ocnqc data
ocnqcDir=$inpDataDir/ocnqc

# path to local gncom data
gncomDir=$inpDataDir/gncom

# paths to model output data
dataDir=$outDataDir/$area
atmosDir=$outDataDir/$area/atmos
oceanDir=$outDataDir/$area/ocean
```

```
waveDir=$outDataDir/$area/wave
obkgdDir=$outDataDir/$area/obkgd
wbkgdDir=$outDataDir/$area/wbkgd
cutoutDir=$outDataDir/$area/cutout

# run archive copy command and archive path
saveDir=$savDataDir/$area
archiveCopyCmd=cp
archiveDir=$savDataDir/$area

# gncom archive copy command and archive path
# (don't include dtg dependence in path, this is handled by retrieve function)
gncomCopyCmd=rcp
gncomArchiveInpDir=newton:/u/d/ooc/data/ncom1/glb8_2a
gncomArchiveOutDir=newton:/u/d/ooc/data/ncom1/glb8_2f/output

# nogaps archive copy command and archive path
nogapsArchiveCopyCmd=rcp
nogapsArchiveDir=newton:/u/home/hodur/masfnmc

# adp archive copy command and archive path
adpArchiveCopyCmd=rcp
adpArchiveDir=newton:/u/home/hodur/adp

# ocnqc archive copy command and archive path
ocnqcArchiveCopyCmd=rcp
ocnqcArchiveDir=newton:/u/home/nachamki/ocnqc

# NCODA plot stuff
plotxyDir=
ncodamapDir=

# NAVDAS stuff
coampsDir=
navdasDir=
navdas_data=
tfileDir=
scrDir=
scrDir2=
expName=

#-----------------------------------------------------------------------#
End_Paths_And_Archive_Commands
printf "\n\n" 1>> $cmdFile
#=======================================================================#

#=======================================================================#
# add execution commands to batch command file
#=======================================================================#

typeset mpicmd
```

```
case $platform in
  babbage)  mpicmd="poe -procs" ;;
  davinci)  mpicmd="poe -procs" ;;
  einstein) mpicmd="aprun -N $ncpus_per_node -n" ;;
esac

cat >> $cmdFile << End_Execution_Commands
#----------------------------------------------------------------------#
# execution commands
#----------------------------------------------------------------------#

# mpi dependent commands
atmos_forecast="$mpicmd $atmos_nprocs $binDir/atmos_forecast.exe"
ocean_forecast="$mpicmd $ocean_nprocs $binDir/ocean_forecast.exe"
wave_forecast="$mpicmd $wave_nprocs $binDir/wave_forecast.exe"
coamps_forecast="$mpicmd $total_nprocs $binDir/coamps_forecast.exe"
atmos_analysis="$mpicmd 1 $binDir/atmos_analysis.exe"
ocean_analysis="$mpicmd 1 $binDir/ncoda"

# non-mpi dependent commands
newdtg="$binDir/newdtg.exe"
cutout="$binDir/cutout.exe"
oceanf_config="$binDir/oceanf_config.exe"
wavef_config="$binDir/wavef_config.exe"
ocean_analysis_prep="$binDir/ncoda_prep"
ocean_analysis_post="$binDir/ncoda_post"
ocean_analysis_convrt="$binDir/ncoda_convrt"

# uncompress command
uncompressCmd=gunzip

#----------------------------------------------------------------------#
End_Execution_Commands
printf "\n\n" 1>> $cmdFile
#======================================================================#

#======================================================================#
# add environment settings to batch command file
#======================================================================#

case $platform in

babbage|davinci)
cat >> $cmdFile << End_Environment_Settings
#----------------------------------------------------------------------#
# environment settings
#----------------------------------------------------------------------#

export MP_INFOLEVEL=1
export MP_STDOUTMODE=unordered
export MP_STDINMODE=all
export MP_LABELIO=no

#----------------------------------------------------------------------#
End_Environment_Settings
;;

einstein)
cat >> $cmdFile << End_Environment_Settings
#----------------------------------------------------------------------#
# environment settings
#----------------------------------------------------------------------#

#----------------------------------------------------------------------#
End_Environment_Settings
;;

esac
printf "\n\n" 1>> $cmdFile
#======================================================================#
#----------------------------------------------------------------------#
# end of script
#----------------------------------------------------------------------#
```

Appendix D: ESMF Configuration Setup Script (setup_esmf_config)

```
#----------------------------------------------------------------------#
#
# Function: setup_esmf_config
#
# Purpose:
#   Create the COAMPS ESMF config input and write it to stdout.
#   If an error occurs, then a non-zero exit status is returned.
#
# Required input parameters:
#   NONE
#
# Global variables required:
#   ddtg, update_cycle, concurrent_cpl_mode,
#   atmos_nprocs, atmosDir, ocean_nprocs, oceanDir, wave_nprocs, waveDir,
#   obkgdDir, wbkgdDir, gocn_step
#
# Global variables created:
#   NONE
#
#----------------------------------------------------------------------#
function setup_esmf_config {

#----------------------------------------------------------------------#
# check for required global variables
#----------------------------------------------------------------------#
if [[ -z $ddtg || -z $update_cycle || -z $concurrent_cpl_mode || \
      -z $atmos_nprocs || -z $atmosDir || -z $ocean_nprocs || -z $oceanDir || \
      -z $wave_nprocs || -z $waveDir || -z $obkgdDir || -z $wbkgdDir || \
      -z $gocn_step ]]
then
  error_msg "$0: required global variables not defined"; return 1
fi
#----------------------------------------------------------------------#

#----------------------------------------------------------------------#
# process input parameters
#----------------------------------------------------------------------#
if [[ $# != 0 ]]
then
  error_msg "$0: incorrect number of input parameters"; return 1
fi
#----------------------------------------------------------------------#

#----------------------------------------------------------------------#
# user setup
#----------------------------------------------------------------------#
#
```

```
# cpl_sec: coupling time-interval in (integer) seconds for coupled forecast
# (must be divisible by the time-step of each coupled forecast model)
#
typeset -i cpl_sec=360

#
# couple_a2o=t/f - coupled forecast with atmos-to-ocean exchange turned on/off
# couple_o2a=t/f - coupled forecast with ocean-to-atmos exchange turned on/off
# couple_a2w=t/f - coupled forecast with atmos-to-wave  exchange turned on/off
# couple_w2a=t/f - coupled forecast with  wave-to-atmos exchange turned on/off
# couple_o2w=t/f - coupled forecast with ocean-to-wave  exchange turned on/off
# couple_w2o=t/f - coupled forecast with  wave-to-ocean exchange turned on/off
#
typeset couple_a2o=t
typeset couple_o2a=t
typeset couple_a2w=t
typeset couple_w2a=t
typeset couple_o2w=t
typeset couple_w2o=t

#
# ocean_export_init_only=t - only initial ocean fields exchanged (couple_o2a=t)
#                       =f - time-varying ocean fields exchanged (couple_o2a=t)
#
typeset ocean_export_init_only=f

#----------------------------------------------------------------------#

#----------------------------------------------------------------------#
# internal settings
#----------------------------------------------------------------------#
# flags indicating which components are enabled
typeset atmos_enabled=f
typeset ocean_enabled=f
typeset  wave_enabled=f
if [[ $couple_a2o == t || $couple_o2a == t ]]
then
  atmos_enabled=t
  ocean_enabled=t
fi
if [[ $couple_a2w == t || $couple_w2a == t ]]
then
  atmos_enabled=t
   wave_enabled=t
fi
if [[ $couple_o2w == t || $couple_w2o == t ]]
then
  ocean_enabled=t
   wave_enabled=t
fi
```

```
# obkgd
typeset obkgd_type=tendency
typeset obkgd_gridnl_file=gridnl.atmos
typeset -i obkgd_tendency_interval=$(( gocn_step * 3600 ))

# wbkgd
typeset wbkgd_type=constant
typeset wbkgd_gridnl_file=gridnl.atmos
typeset -i wbkgd_tendency_interval=$(( gocn_step * 3600 ))
#----------------------------------------------------------------------#

#----------------------------------------------------------------------#
# check for consistency with atmos/ocean/wave setup
#----------------------------------------------------------------------#
typeset -E dta=10000
typeset -E dto=10000
typeset -E dtw=10000
typeset -E rta=0
typeset -E rto=0
typeset -E rtw=0

# get atmos timestep and ratio wrt coupling interval
if [[ $atmos_enabled == t ]]
then
  dta=$(nlvar delta $prjDir/setup_nl_coamnl) \
  || { error_msg "$0:$LINENO: get atmos timestep failed"; return 1; }
  rta=$(( fmod(cpl_sec,dta) ))
fi

# get ocean timestep and ratio wrt coupling interval
if [[ $ocean_enabled == t ]]
then
  dto=$(shvar dti_base $prjDir/setup_nl_oparm) \
  || { error_msg "$0:$LINENO: get ocean timestep failed"; return 1; }
  rto=$(( fmod(cpl_sec,dto) ))
fi

# get wave timestep and ratio wrt coupling interval
if [[ $wave_enabled == t ]]
then
  dtw=$(shvar dtw $prjDir/setup_swan_input) \
  || { error_msg "$0:$LINENO: get wave timestep failed"; return 1; }
  rtw=$(( fmod(cpl_sec,dtw) ))
fi

# check that coupling interval is divisible by model timesteps
if [[ $rta != 0 || $rto != 0 || $rtw != 0 ]]
then
  error_msg "$0:$LINENO: coupling interval is not divisible by model timesteps" \
            "atmos timestep: $dta" \
            "ocean timestep: $dto" \
            "wave  timestep: $dtw" \
            "coupling interval: $cpl_sec"
  return 1
fi
#----------------------------------------------------------------------#

#----------------------------------------------------------------------#
# generate namelist
#----------------------------------------------------------------------#
cat << end_namelist
########################################################################
########################################################################
# COAMPS ESMF configuration file
########################################################################
########################################################################

########################################################################
# Base date-time group
########################################################################

base_dtg:   ${ddtg}

########################################################################
# Start time
########################################################################

start_hour: 0
start_min:  0
start_sec:  0

########################################################################
# End time
########################################################################

end_hour:   ${update_cycle}
end_min:    0
end_sec:    0

########################################################################
# Coupling interval -- must be divisible by the time step
# of each enabled component
########################################################################

cpl_hour:   0
cpl_min:    0
cpl_sec:    ${cpl_sec}

########################################################################
# Execution mode
########################################################################
```

```
concurrent_cpl_mode: ${concurrent_cpl_mode}

########################################################################
# Atmos component
########################################################################

atmos_num_pets: ${atmos_nprocs}
atmos_gridnl_file: gridnl.atmos
atmos_data_dir: ${atmosDir}
atmos_export_avg_enable: t
atmos_outff_flag: f
atmos_outff_interval: 3600

########################################################################
# Ocean component
########################################################################

ocean_num_pets: ${ocean_nprocs}
ocean_gridnl_file: gridnl.ocean
ocean_data_dir: ${oceanDir}
ocean_outff_flag: f
ocean_outff_interval: 3600
ocean_nest1_to_egrid_flag: t

########################################################################
# Wave component
########################################################################

wave_num_pets: ${wave_nprocs}
wave_gridnl_file: gridnl.wave
wave_data_dir: ${waveDir}
wave_outff_flag: f
wave_outff_interval: 3600

########################################################################
# Coupling
#
# pmsl   : air_pressure_at_sea_level
# tauu   : surface_downward_eastward_stress
# tauv   : surface_downward_northward_stress
# hfns   : surface_downward_heat_flux
# mfns   : surface_downward_moisture_flux
# risw   : isotropic_shortwave_radiance_in_air
# sst    : sea_surface_temperature
# wndu   : eastward_10m_wind
# wndv   : northward_10m_wind
# chnk   : wave_induced_charnock_parameter
# wvst   : surface_total_wave_induced_stress
# wvsu   : surface_eastward_wave_induced_stress
# wvsv   : surface_northward_wave_induced_stress
# ssh    : sea_surface_height_above_sea_level
# sscu   : surface_eastward_sea_water_velocity
# sscv   : surface_northward_sea_water_velocity
# sdcu   : eastward_stokes_drift_current
# sdcv   : northward_stokes_drift_current
# wbcu   : eastward_wave_bottom_current
# wbcv   : northward_wave_bottom_current
# wbcf   : wave_bottom_current_radian_frequency
# wsuu   : eastward_wave_radiation_stress
# wsuv   : eastward_northward_wave_radiation_stress
# wsvv   : northward_wave_radiation_stress
# wsgu   : eastward_wave_radiation_stress_gradient
# wsgv   : northward_wave_radiation_stress_gradient
#
# wave_export_chnk_type: 1=w2a_janssen, 2=w2a_moon
#
########################################################################

cpl_atmos_to_ocean: ${couple_a2o}
cpl_atmos_to_ocean_field_list: pmsl tauu tauv hfns mfns risw
cpl_ocean_to_atmos: ${couple_o2a}
cpl_ocean_to_atmos_field_list: sst
cpl_atmos_to_wave: ${couple_a2w}
cpl_atmos_to_wave_field_list: wndu wndv
cpl_wave_to_atmos: ${couple_w2a}
cpl_wave_to_atmos_field_list: chnk
cpl_ocean_to_wave: ${couple_o2w}
cpl_ocean_to_wave_field_list: ssh sscu sscv
cpl_wave_to_ocean: ${couple_w2o}
cpl_wave_to_ocean_field_list: sdcu sdcv wbcu wbcv wbcf wsgu wsgv

wave_export_chnk_type: 2

########################################################################
# Ocean background -- these settings are used when the
# ocean-to-atmos or ocean-to-wave coupling is enabled.
#
# Wave background -- these settings are used when the
# wave-to-atmos or wave-to-ocean coupling is enabled.
#
# Available background types:
#     constant : Background values are constant in space
#                and time.
#     analysis : Background values are obtained from the
#                tau0 analysis and remain fixed in time.
#                When this option is selected the data
#                directory must be provided.
#     tendency : Background values are obtained from input
#                tendency files.  When this option is
#                selected the data directory and tendency
#                interval must be provided.
########################################################################
```

```
obkgd_type: ${obkgd_type}
obkgd_gridnl_file: ${obkgd_gridnl_file}
obkgd_data_dir: ${obkgdDir}
obkgd_tendency_interval: ${obkgd_tendency_interval}

wbkgd_type: ${wbkgd_type}
wbkgd_gridnl_file: ${wbkgd_gridnl_file}
wbkgd_data_dir: ${wbkgdDir}
wbkgd_tendency_interval: ${wbkgd_tendency_interval}

########################################################################
# Optional parameters for controlling the calculation of
# the regrid sparse matrices.
#   regrid_interp_method:
#     - type of interp method
#     - 1=bilinear (default), 2=bicubic
#   regrid_extrap_nnbrl:
#     - multiplier for number nnbr search levels for extrap
#     - >=1 (default=2)
########################################################################

regrid_interp_method: 1
regrid_extrap_nnbrl: 24

########################################################################
########################################################################
# end COAMPS ESMF configuration file
########################################################################
########################################################################
end_namelist
#----------------------------------------------------------------------#

#----------------------------------------------------------------------#
# end of function
#----------------------------------------------------------------------#
```

Appendix E: Data Retrieval Script (run_retrieve)

```
#!/bin/ksh
#------------------------------------------------------------------------------#
#
# Script: run_retrieve
#
# Purpose:
#   To retrieve global and obs data from archive
#
# Usage:
#   run_retrieve [options] ddtgs ddtge
#
# Required input parameters:
#   ddtgs    : beginning date-time-group (yyyymmddhh)
#   ddtge    : ending    date-time-group (yyyymmddhh)
#
# Optional input parameters:
#   -h       : help (print usage)
#   (for details see usage function below or execute with -h)
#
#------------------------------------------------------------------------------#
myname=$(basename $0) #name of this script

# scpDir: path to COAMPS run/scripts
scpDir=$(dirname $0)

# convert scripts path from "relative" to "absolute"
D=$(dirname $scpDir); B=$(basename $scpDir);
scpDir=$(cd $D 2>/dev/null && pwd || print $D)/$B

# jobDir: path to job directory (where this script is invoked)
jobDir=$(pwd)

#------------------------------------------------------------------------------#
# process input
#------------------------------------------------------------------------------#

# usage function
function usage {
  print '\n------------------------------------------------------------------' 2>&1
  print "Usage: $myname [options] ddtgs ddtge" 2>&1
  print "" 2>&1
  print "Required:" 2>&1
  print "  ddtgs : beginning date-time-group (yyyymmddhh)" 2>&1
  print "  ddtge : ending    date-time-group (yyyymmddhh)" 2>&1
  print "" 2>&1
  print "Options:" 2>&1
  print "  -h   : help - print usage and exit" 2>&1
  print "  -k <kuser> : kerberos userid (required if different from local userid)" 2>&1
  print "" 2>&1
  print "  Observational data option:" 1>&1
  print "  -d 0 : no action (default)" 1>&1
  print "     1 : retrieve atmos obs data from archive" 1>&1
  print "     2 : retrieve ocean obs data from archive" 1>&1
  print "     3 : (1) & (2)" 2>&1
  print "" 2>&1
  print "  Global model data option:" 2>&1
  print "  -g 0 : no action (default)" 1>&1
  print "     1 : retrieve global atmos data from archive" 2>&1
  print "     2 : retrieve global ocean data from archive" 2>&1
  print "     3 : (1) & (2)" 2>&1
  print '\n-----------------------------------------------------------------\n' 2>&1
}

# initialize option-related variables
kuser=$( whoami )
obs_data_option=0
global_model_data_option=0

# process command-line options
while getopts "hk:d#g#" opt
do
  case $opt in
    h ) usage ; exit 0 ;;
    k ) kuser=$OPTARG ;;
    d ) case $OPTARG in
          [0-3]) obs_data_option=$OPTARG ;;
          *    ) usage ; exit 1 ;;
        esac ;;
    g ) case $OPTARG in
          [0-3]) global_model_data_option=$OPTARG ;;
          *    ) usage ; exit 1 ;;
        esac ;;
    \?) usage ; exit 1 ;;
  esac
done
shift $(($OPTIND - 1))

# process required arguments
if [[ $# -eq 2 ]]
then
  ddtgs=$1 ; shift
  ddtge=$1 ; shift
else
  usage
  print "$myname: ERROR -- incorrect number of required arguments provided" 1>&2
  exit 1
fi
```

```
# check for valid ddtgs
if [[ ${ddtgs} != +([0-9]) ]]
then
  usage
  print "$myname: ERROR -- ddtgs is not an integer" 1>&2
  exit 1
fi
if [[ ${#ddtgs} -ne 10 ]]
then
  usage
  print "$myname: ERROR -- incorrect format for ddtgs" 1>&2
  exit 1
fi

# check for valid ddtge
if [[ ${ddtge} != +([0-9]) ]]
then
  usage
  print "$myname: ERROR -- ddtge is not an integer" 1>&2
  exit 1
fi
if [[ ${#ddtge} -ne 10 ]]
then
  usage
  print "$myname: ERROR -- incorrect format for ddtge" 1>&2
  exit 1
fi
if [[ $ddtge -lt $ddtgs ]]
then
  usage
  print "$myname: ERROR -- ddtge must be at or later than ddtgs" 1>&2
  print "$myname: ERROR --   ddtgs = $ddtgs" 1>&2
  print "$myname: ERROR --   ddtge = $ddtge" 1>&2
  exit 1
fi

# COAMPS bin directory
binDir="/u/COAMPS/src/coamps5/bin"

# newdtg command
newdtg="$binDir/newdtg.exe"

# uncompress command
uncompressCmd=gunzip

# path to local f and adp data
fandaDir=/u/COAMPS/input/fanda

# path to local ocnqc data
ocnqcDir=/u/COAMPS/input/ocnqc
```

```
# path to local gncom data
gncomDir=/u/COAMPS/input/gncom


#------------------------------------------------------------------------------#
# add scripts and projects directories to search path
#------------------------------------------------------------------------------#

PATH=$scpDir:$PATH
FPATH=$scpDir
export PATH FPATH

#------------------------------------------------------------------------------#
# report
#------------------------------------------------------------------------------#

info_msg "============================================================"
info_msg "===== BEGIN JOB ====="
info_msg "user defined begin date-time-group: $ddtgs" \
         "user defined end   date-time-group: $ddtge"
info_msg "============================================================"
info_msg "===== COMMAND-LINE OPTIONS ====="
info_msg "obs_data_option: $obs_data_option"
info_msg "global_model_data_option: $global_model_data_option"
info_msg "============================================================"

#------------------------------------------------------------------------------#
# retrieve observational data from archive
#------------------------------------------------------------------------------#

# atmos
case $obs_data_option in
  1|3)
    retrieve_atmos_obs_data \
    || { error_msg "$myname:$LINENO: retrieve_atmos_obs_data failed";
         exit 1; } ;;
esac

# ocean
case $obs_data_option in
  2|3)
    retrieve_ocean_obs_data \
    || { error_msg "$myname:$LINENO: retrieve_ocean_obs_data failed";
         exit 1; } ;;
esac

#------------------------------------------------------------------------------#
# retrieve global model data from archive
#------------------------------------------------------------------------------#

# atmos
```

```
case $global_model_data_option in
  1|3)
    retrieve_global_atmos_data \
    || { error_msg "$myname:$LINENO: retrieve_global_atmos_data failed";
         exit 1; } ;;
esac

# ocean
case $global_model_data_option in
  2|3)
    retrieve_global_ocean_data \
    || { error_msg "$myname:$LINENO: retrieve_global_ocean_data failed";
         exit 1; } ;;
esac

#-------------------------------------------------------------------------------#
# end of script
#-------------------------------------------------------------------------------#
```

Appendix F: Atmospheric, Ocean, and Namelist Parameters

The following list of parameters is specific to coding and scripts written for COAMPS. Parameters common to NCOM COAMPS may be found in the respective User's Manuals (Martin et al., 2008b; Chen et al., 2003).

Parameter	Description	Default
coampsV	Specifies the COAMPS version.	5
concurrent_cpl_mode	Runs a coupled forecast in sequential mode ("f") or on different processors concurrently ("t").	"f"
couple_a2o	Specifies a coupled forecast with atm. to ocn. exchange.	
couple_o2a	Specifies a coupled forecast with ocn. to atm. exchange.	
cpl_sec	Specifies the coupling interval (in s).	360
delta	Specifies the time step (in s) for the atm. model.	90
dsigma	Sigma level specifications.	
dti_base	Time step for ocean nest 1.	
gatm_fcst	Global atm. forecast/hindcast LBC flag.	"f"
gatm_length	End forecast hour to get global atm. fields.	12
gatm_step	Frequency (in hrs) of the global atm. fields.	6
gocn_fcst	Defines the source for the LBCS: "f" for hindcast GNCOM files, "t" for global ocean forecast.	"f"
gocn_length	End forecast hour to get global ocean fields.	12
gocn_step	Frequency (in hrs) of the global ocean fields.	6
indiag	Prints out diagnostics to the screen.	1
indriv	River input parameter. (1) is "on" and (0) is "off".	
kka	Number of atmospheric levels.	40
kkom	Total number of ocean levels.	50
kkso	Number of sigma levels used in NCOM.	18, but 35 if using RELO NCOM

Parameter	Description	Default
		IC/BCs.
l2way	Controls feedback between nests.	"f"
lm	Number of MVOI levels.	16
lmbc	Number of boundary condition levels.	26
locean	Designates whether COAMPS or RELO NCOM is used for IC/BCs.	
njump	Radiation scheme type used by atm. model.	1
nnest	Number of atmospheric nests.	
nradtyp	Radiation scheme type used by atm. model.	1
ocean_export_init_only	Specifies whether initial ("t") or time-varying fields ("f") are exchanged in the coupling.	
projAcct	Sets the COAMPS project account number for the DSRC.	
update_cycle	Sets the hindcast/forecast update cycle.	12
wallTime	Amount of time a user may request for a COAMPS run.	

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